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Little Lost River Subbasin at a Glance:	
Hydrologic Unit Code	17040217
1996 Water Quality Limited Segments	Badger Creek, Deer Creek, Dry Creek (2), Sawmill Creek, Wet Creek
Beneficial Uses Affected	Cold Water Biota Salmonid Spawning
Pollutants of Concern	Sediment, Temperature Nutrients, Flow Alteration
Major Land Uses	Forestry, Agriculture
Area	963 sq. miles
Population (1990)	325

LITTLE LOST RIVER - INTRODUCTION

Although produced as a stand alone document, this subbasin assessment is but one part of what will be three parts - Executive Summary, Subbasin Assessment, and Leoding Analyses - that compose a total maximum daily load (TMDL) for the Little Lost River subbasin. This assessment describes the physical, biological, and cultural setting, water quality status, pollutant sources, and recent pollution control actions in the Little Lost River subbasin located in southeastern Idaho. Problem assessment is an important first step leading to the loading analyses required by §303(d) of the Clean Water Act (33 U.S. Code Section 1251-1387). The starting point is Idaho's 1996 §303(d) list of water quality limited waterbodies and eight-year TMDL development schedule. Six listed segments in the Little Lost subbasin were put on the §303(d) list in 1994. As that list is based on limited and dated information, this assessment will clarify the current status of these waters, and better define the extent of impairment and causes of water quality limitation throughout the subbasin.

This assessment is not a substitute for the State of Idaho's normal biennial §303(d) listing process. However, some currently listed waters, or portions thereof, are identified as meeting their beneficial uses and thus do not require a TMDL. If an updated §303(d) list is not finalized prior to the due date for TMDLs in the Little Lost River subbasin, then those listed waters found to be meeting water quality standards would be proposed for de-listing concurrent with formal public review of the TMDL. On the other hand, some waters not currently listed are identified here as water quality impaired. Identifying these waters now allows remedial actions or further monitoring to take place prior to the next biennial listing. If those actions are insufficient to restore the water to full support of beneficial uses within a reasonable time, or additional monitoring data do not indicate water quality meets state standards, these waters would be candidates for Idaho's next §303(d) list.

This analysis used readily available information from geographic information system (GIS) coverages obtained by the Division of Environmental Quality (DEQ), monitoring results, data downloaded from internet sources, published reports and maps, and data received from other sources in response to a mailed request for such data. Major contributors include the Bureau of Land Management Idaho Falls office, US Forest Service Salmon/Challis National Forest, and the US Geological Survey Water Resources Division office in Boise.

The Little Lost River subbasin (Figure 1) comprises an area of 963 square miles covering portions of Butte, Custer, and Lemhi counties. This subbasin is defined by the watershed boundaries of the entire Little Lost River, also known as fourth field hydrologic unit, or cataloging unit, 17040217. Many of the streams in this subbasin experience excessive channel bedlosses, including the Little Lost River itself. The river get its name from the fact that its entire flow sinks into the porous basalt of the Snake River plain southeast of Howe and is thus lost. There are also numerous valley floor springs and spring-fed tributaries which counteract bed losses in the Little Lost River and make the lower valley more drought-resistant than the Big Lost valley to the west. As a result of its geologic history, the Little Lost River is unique among Upper Snake River subbasins in harboring bull trout (*Salvelinus confluentus*). The lack of surface hydrologic connection has isolated fisheries from the remainder of the upper Snake River basin.

The Little Lost River flows through a high elevation, cool desert, valley in a portion of the northern Basin and Range separated from the bulk of basin and range lands to the south by the Snake River Plain. A northwest to southeast trending graben or fault block formed the basin or valley and is flanked by the Lost River Range to the west and the Lemhi Range to the east. The valley bottom is a semi-arid sagebrush plain 4800-6500 feet in elevation along its axis. Parallel mountain ranges rise to 11000+ feet on either side with a broken band of forest at about 8000-9500 feet.

Population is sparse, with a total 1990 population of 325. Howe, at the lower end of the valley, is the largest community with a 1990 population of 20. Agriculture is the principal land use and cattle and sheep ranching the main economic activity in the valley. There are no permitted point sources. Small scale limited timber harvesting has occurred, primarily in the upper Sawmill Creek watershed.

1. CHARACTERIZATION OF SUBBASIN

1.1. Physical Characteristics

Setting and Topography

The Little Lost River subbasin is located in eastern Idaho on the northern margin of the Snake River plain (see Figure 1.) The watershed is approximately 50 miles long by 20 miles wide (963 square miles). The valley floor averages 7 miles in width, and is fairly consistent in width from the head of the valley to the mouth. Shaped like a long rectangle, it contains a high elevation valley flanked by the Lost River Range to the west and the Lemhi Range to the east.

The spine of Lost River Range near the subbasin is predominately 10,000 feet in elevation, varying from 12,000 feet (Mount Breitenbach) in the north to 8,500 feet (Howe Peak) in the south. Most of the Lemhi Range is close to 11,000 feet in elevation with the ridge line ranging from 12,200 feet (Diamond Peak) to 10,800 feet (Saddle Mountain). Figure 1. shows the location of the various elevations described in this section.

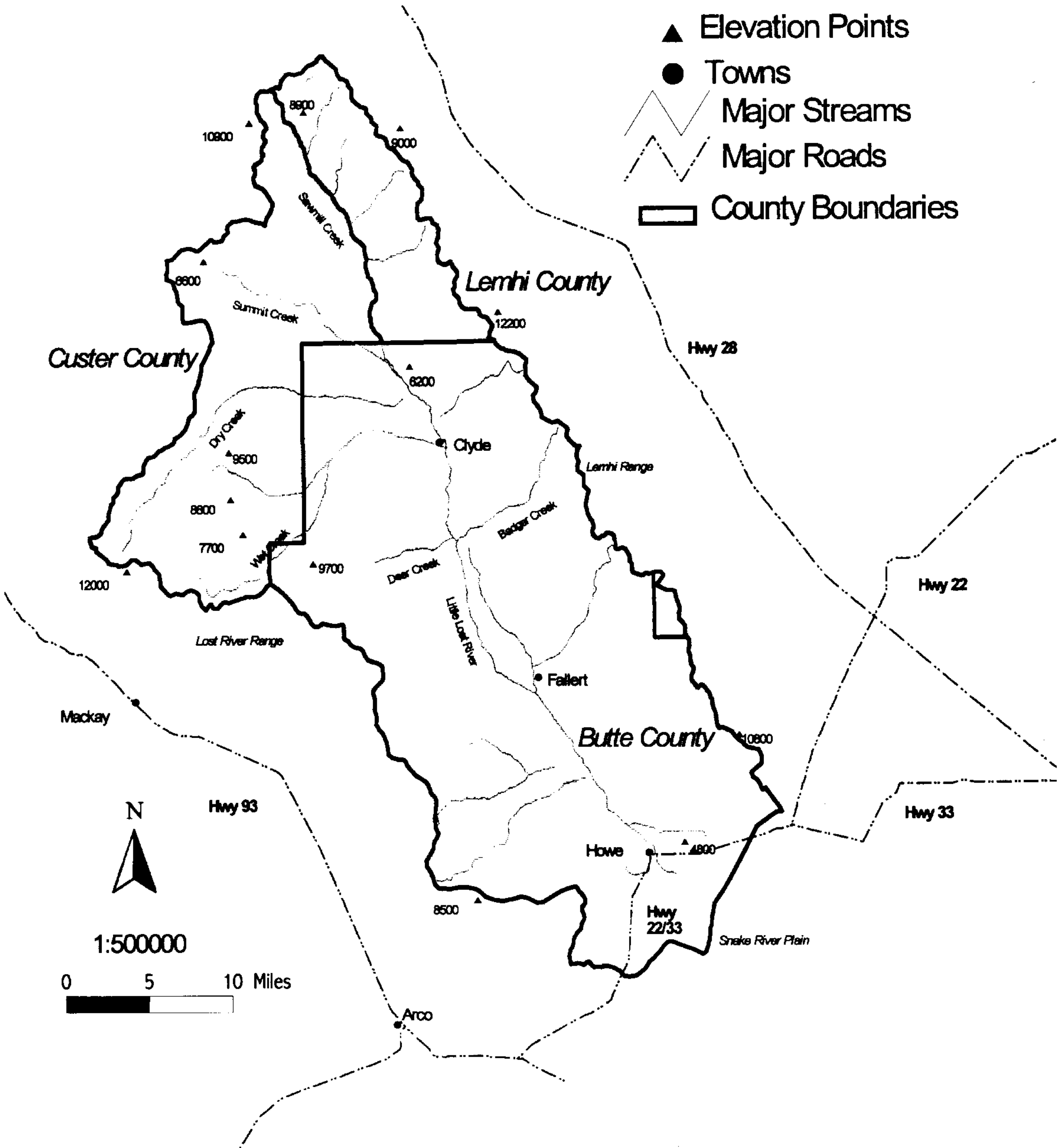
The northwestern portion of the subbasin broadens a bit with several mountains and hills in the valley located between the Lost River Range and the Little Lost River. The Donkey Hills, located just west of Summit Creek, reach an elevation of 9,500 feet. Just to the south of the Donkey Hills is Taylor Mountain at an elevation of 8,600 feet. Below Taylor Mountain are the Red Hills with an elevation of 7,700 feet. Between the Red Hills and Deer Creek are the Hawley Mountains which reach an elevation of 9,700 feet.

Sawmill Creek elevation reaches 7,200 feet near Timber Creek at the head of Sawmill Canyon with surrounding mountains varying in elevation from 9,000 to 10,900 feet. Sawmill Creek joins Summit Creek at 6,200 feet in elevation. To the north of Summit Reservoir a pass leading into the Pahsimeroi Valley rests at about 6,700 feet. The valley bottom ranges in elevation from 6,600 feet near the source of Summit Creek in the north to 4,800 feet near the Little Lost River Sinks, resulting in an approximate average valley gradient of 38 feet/mile (the gradient is steeper in the upper reaches of the valley).

Climate

The valley bottom of the Little Lost River basin can be characterized as a high desert. Average annual precipitation is less than 10" per year over much of the valley. Winters are long and cold while summers are brief and hot. Precipitation rises in the flanking mountains to 35 inches or more, falling mostly as snow. A more detailed description of this area's climate is in Appendix A.

Figure 1. - Little Lost River Subbasin



Hydrography/Hydrology

The Little Lost River, the largest stream in the subbasin, flows southeastward between the Lost River and Lemhi Ranges. The headwaters of the river are located in the far north corner of the subbasin in Sawmill Canyon. Several tributaries join the river in the canyon before it meets Summit Creek in the valley. Figure 2. shows the hydrography of the subbasin as well as the boundaries of the fifth field watersheds.

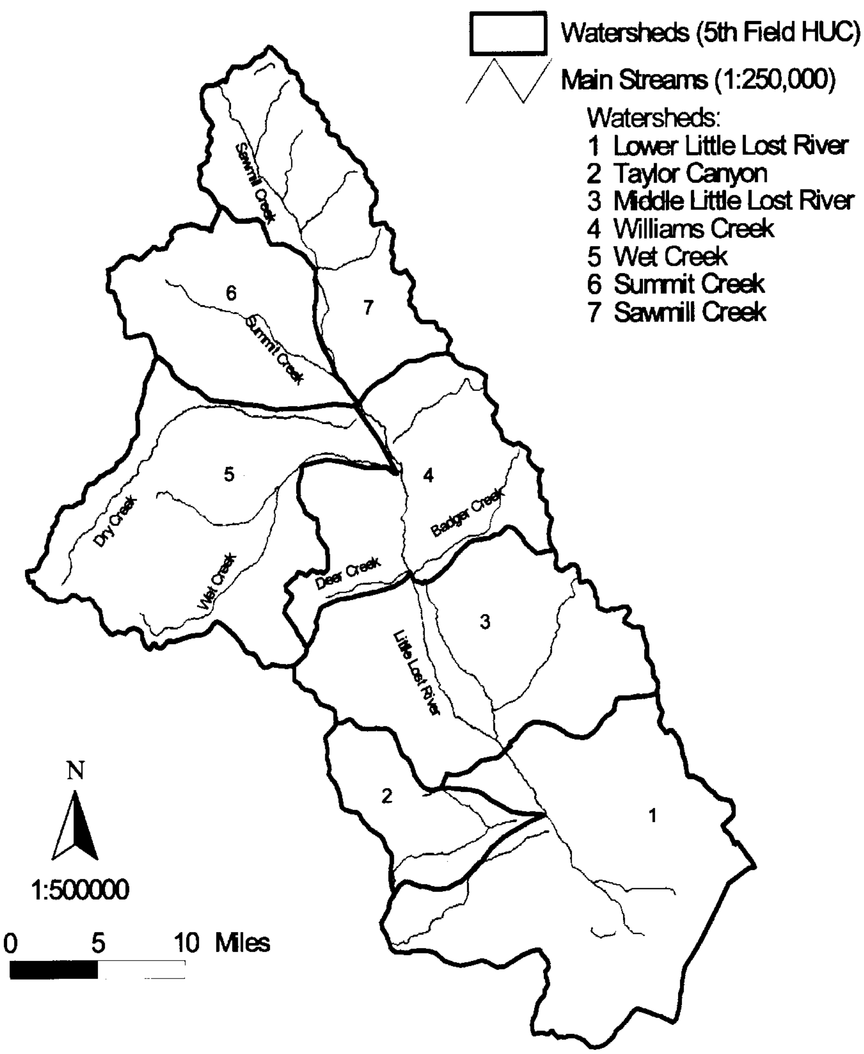
Some maps of the area, such as the Challis National Forest Map, refer to this upper portion as the Little Lost River, while United States Geological Survey (USGS) maps and the Geographic Names Information System refer to the mainstem above Summit Creek as Sawmill Creek. The later is the convention used here. Thus the Little Lost River begins at the junction of Sawmill and Summit Creeks about 4 miles northwest of Clyde. The river then flows almost directly down the middle of a large rectangular valley filled with glacial alluvium.

Sawmill Creek rises in the Lemhi Range and flows initially on consolidated rock for 12 to 14 miles. Sawmill then loses up to 50% of its water by percolation to underlying alluvial sediments from the point it enters the valley floor to its juncture with Summit Creek (Andrews 1972). Summit Creek rises in numerous springs and seeps at the northwest end of the basin. Other major tributaries to the Little Lost River include Dry Creek and Wet Creek from the northwest corner of the subbasin. Although now diverted, Dry Creek was also a losing stream (flows decreasing downstream due to bed loss) which likely discharged to the Little Lost River only during spring runoff.

Below Clyde a number of spring-fed tributaries enter the Little Lost River including Williams Creek and Badger Creek from the Lemhi range, and Deer Creek from the Lost River range. The remainder of the mountain tributaries are short and flow steeply off the flanking mountains producing large alluvial fans (up to 900 m deep) extending more than halfway across the valley in places. Except during times of high runoff, most of the creeks entering the valley from side canyons disappear into their alluvium before reaching the river. Consequently, most of the runoff to the Little Lost River below Badger Creek is through subsurface flow and spring-fed valley streams such as Big Springs and Fallert Springs Creeks arising in the valley rather than the mountains.

Mundorf and others (1963) reported that the valley bottom aquifer rises to the surface for 2-3 miles below the confluence of Summit and Sawmill Creeks creating a natural swampy area and feeding flow in the river. For the next 7-8 miles the water table is within 15-20 feet of the surface and rises to the surface again below the mouth of Badger Creek contributing flow to the Little Lost through several springs. The water table then dips only to rise to the surface one more time for 3-4 miles around Fallert before diving to 200 feet or more below ground in the vicinity of Howe.

Figure 2 - Major Hydrography and Watersheds



Little Lost River Subbasin - 4th Field HUC

Total discharge has been reported to be greater below Badger Creek due to the inflow of spring-fed creeks upstream and a large ridge extending from the Lemhi Range that forces the water table to the surface at Fallert (Andrews 1972). The significant spring-dominated flow regime in the lower valley has made this valley more resistant to drought than the Big Lost valley to the west. The river disappears into an ephemeral playa, the Little Lost River Sink, just south of Howe on the margin of the Snake River Plain. The river sometimes drains into the Big Lost River Sinks during times of extremely high runoff (Bartholomay 1990).

Little Lost Hydrology

Annual hydrographs of the Little Lost River show a late-spring early summer snowmelt peak. There is less than a ten-fold range in mean monthly discharge and minimum flows typically occur in mid-winter. Overall run-off is less than 1.7 inches, discounting diversions for irrigation of about 4000 acres. A more detailed analysis of USGS hydrology data is in Appendix B.

Geology

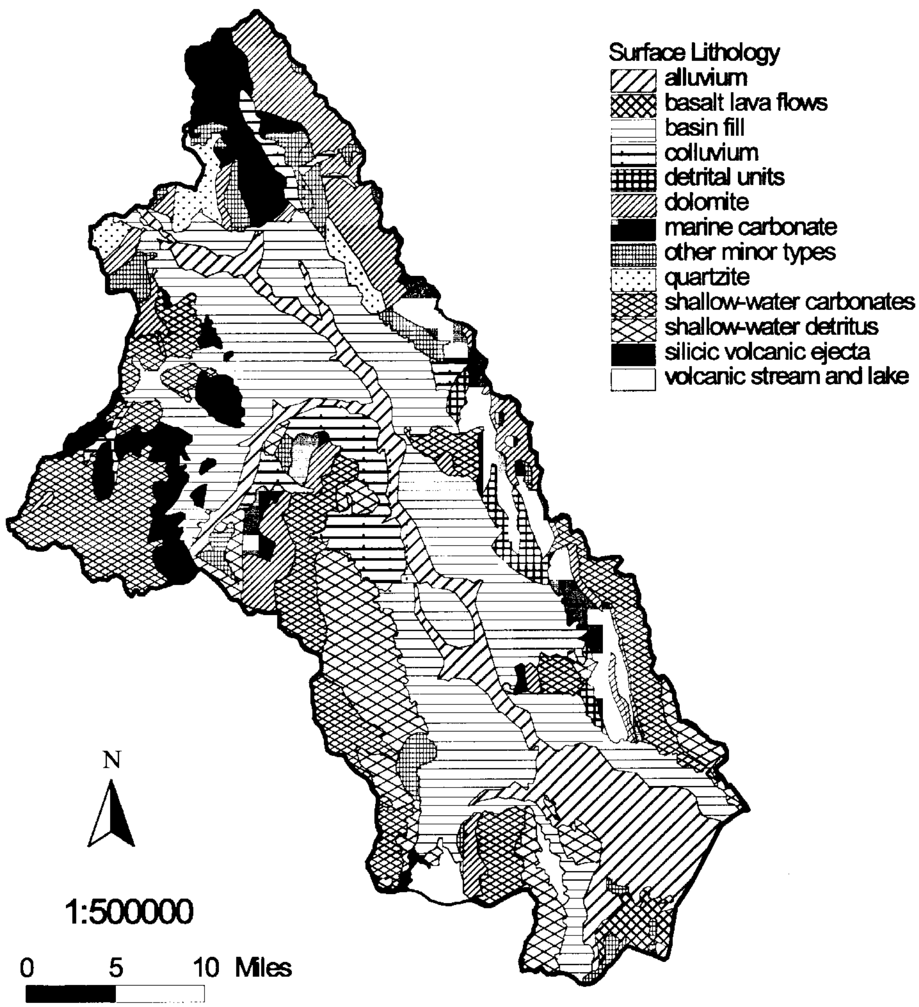
This geologic description of the Little Lost River subbasin was compiled from Stearns and others (1938), Mundorf and others (1964), and Alt and Hyndman (1989). Figure 3 is a map of surficial lithology of the area from a GIS cover based on Bond and Wood (1978).

Geologically complex, the bounding mountain ranges are for the most part formed of Paleozoic sedimentary rocks, including folded and faulted limestones, quartzites and shales. Local occurrences of Tertiary volcanic rocks of the Challis formation, chiefly andesitic or silicic in composition, constitute a portion of these mountains also. These appear to be found chiefly in the upper drainages of Wet and Dry Creeks in the Lost River Range, and the west side of Sawmill Creek in the Lemhi Range. Both ranges terminate at their southeastern margin in the Eastern Snake River Plain where basalt is the predominant lithology. The Little Lost River valley is apparently formed in a down-faulted block of consolidated rocks, similar to those in the uplands. The river flows on alluvium, resulting from erosion of the flanks of the mountains, that has partially filled the valley.

These bordering mountain ranges began to take form by the middle Cenozoic, prior to the subsidence of the Snake River Plain which began in Late Cenozoic time. These ranges are a result of a northeastern extension of the underlying continental crust, and the consequent block-faulted Basin and Range topography characteristic of this part of the West. Uplift, tilting, faulting and the concurrent subsidence of the Little Lost River basin (and watershed) has continued to the present. A significant factor in terms of the surficial geology of the basin, operating late in the history of this area, is the work of glaciers during the Pleistocene. These glaciers added debris, in the form of terraces and outwash deposits, to the valley (see Figure 3.).

Since Quaternary time tributary streams have filled the valley with alluvium to considerable depth, perhaps as much as 3000 feet. An obvious feature of the valley today is a series of coalescing

Figure 3 - Geology



Little Lost River Subbasin - 4th Field HUC

alluvial fans consisting of poorly sorted materials eroded form the flanking mountains. Toward the center of the valley the Little Lost River has reworked, somewhat leveled, and better sorted the alluvial deposits. This alluvium hosts a large reservoir of groundwater which feeds the many springs in the subbasin. Soils formed on this alluvium are for the most part thin, stony and well drained.

Soils

The types of soils in the subbasin affect many aspects of surface water, particularly the quantity and texture of sediment in the water bodies. In the Little Lost River subbasin, the surface soil texture is predominately gravelly loam throughout the valley and along the mountain ranges. Gravelly loam is not as erodible as other soil textures, but it is difficult for vegetation to grow in this coarse soil and provide cohesiveness. There is some loam, sandy loam, clay loam and silt loam in small portions of the valley. In the mountain ranges toward the ridge line, stony loam, cobbly loam, unweathered bedrock and fragmented material cover the slopes. Table 1. identifies soil textures for various soil map units in the subbasin and Figure 4. shows the distribution of those soil map units.

Table 1. also shows soil depth, average slope, and average K factor for each map unit (based on STATSGO, USDA-SCS 1991). As expected, the soil depth is deeper in the valley bottom and shallower along the hillsides and mountain slopes. Most of the valley bottom soil is about 56 to 60 inches deep while the hillside soils range from 34 to 56 inches deep. Along the top of the mountain ridges and at the southern tip of the basin (Little Lost River Sinks) the soil is fairly shallow at about 20 to 34 inches deep.

The average soil slope provides a gage of potential soil erosion, or erodibility risk. Soil slope, a calculation of slope length and rise, was averaged for the various map units. As anticipated, the slopes were low (3-9%) in the valley and gradually increased as one approached the two bordering mountain ranges. The slopes are fairly steep in the mountain ranges particularly along the Lemhi Range where average slopes were greater than 44% in places. Figure 5. shows the distribution of the weighted average soil slope.

The K-factor is the soil erodibility factor in the Universal Soil Loss Equation. The factor is comprised of four soil properties: texture, organic matter content, soil structure, and permeability. The K-factor values range from 1.0 (most erosive) to 0.01 (nearly nonerosive). As seen in Figure 6., the weighted average K-factors are fairly low to moderate (0.08 to 0.34) for this semi-arid subbasin comprised of mainly coarse soil textures. In comparing the factors for the subbasin, the values are lowest along the mountain ridges where unweathered bedrock and fragmented material is found. The valley and surrounding hillsides show a range of 0.08 to 0.17 except for portions in the north and a section in the south.

Map Unit I.D. 180 in the northern section shows the highest erosion potential for the subbasin at an average K-factor of 0.34. The soil is naturally low in organic matter and its texture is finer with mainly loam and gravelly loam at an average soil depth of 60 inches. This area includes the mouths of Sawmill and Summit Creeks and the lower portions of Dry and Wet Creeks. To the near west are the volcanic Donkey Hills and Taylor Mountain. Both of these areas may contribute to the finer soil texture and the higher K-factor.

The portion to the south, Map Unit I.D. 140, has a 0.26 weighted average K-factor. The area has a low average slope that varies from 1.2% to 4.8% and contains some very gravelly loam. However, the section also contains finer soil textures such as loam, silt loam and clay loam and is located close to the Little Lost River Sinks which may reduce soil permeability and increase the K-factor. The other areas that fall in the 0.17 to 0.26 range are Map Unit I.D.s 153, 187, 197, and 198. The soils have an average depth of 55 to 60 inches and low organic matter content. Map Unit I.D. 153 is located on fairly steep slopes ranging from 21.4% to 45.8%.

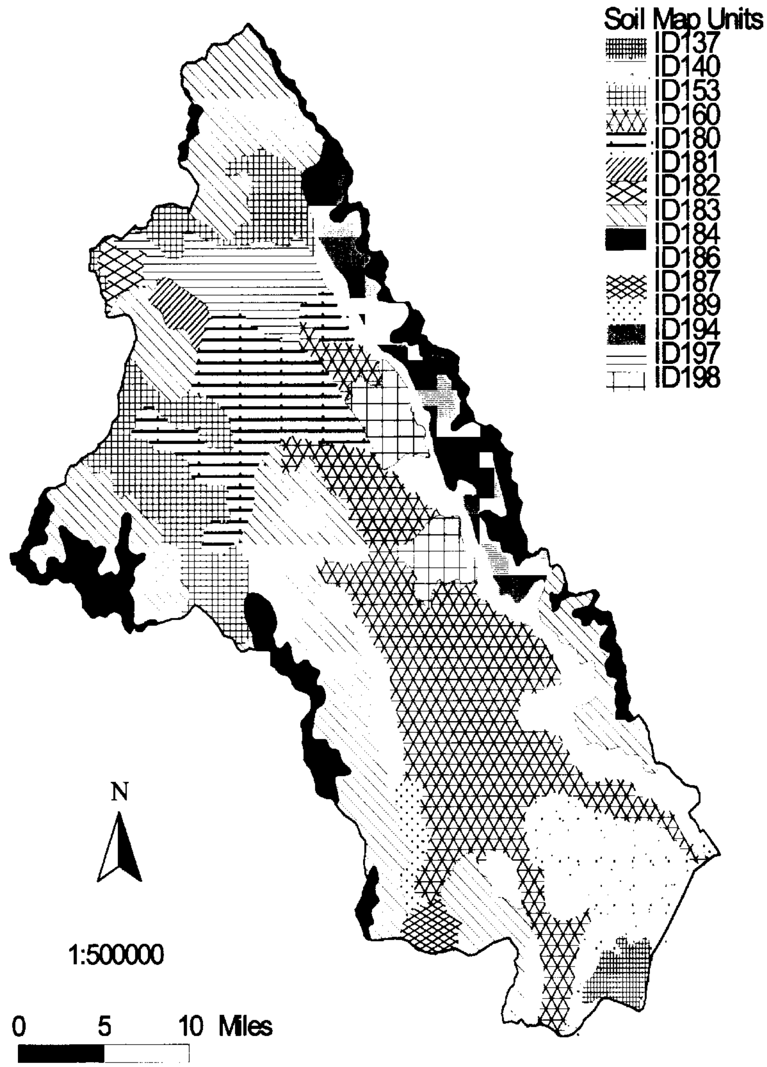
Table 1. Little Lost River Subbasin - STATSGO Soil Summary

Map Unit ID	Acres	Sq Mi	Name	Ave Slope (%)	Ave K Factor	Ave Depth (in)	Ave Slope Low	Ave Slope High	Soil Texture (Surface)
ID137	6,455	10.1	Aecet-Rock Outcrop-Bereniceton	17.2	0.17	30	0.8	33.7	Very stony silt loam (-50%) and unweathered bedrock (-25%). Some loam, silt loam, sandy loam, silty clay loam.
ID140	37,344	58.4	Whiteknob-Bereniceton-Medicine	3.0	0.26	59	1.2	4.8	Loam and very gravelly loam. Some silt loam and clay loam.
ID153	52,521	82.1	Hagenbarth - Howcan - Resoot	33.6	0.22	55	21.4	45.8	Gravelly loam and a smaller portion of silt loam (-25%). Some very gravelly loam, gravelly, clay, and stony loam.
ID160	124,931	195.2	Paint-Simeroi - Whitecloud	5.0	0.16	60	2.0	8.0	Gravelly loam and small portion (-5%) of very gravelly loam.
ID180	47,434	74.1	Nicholia- Combe-Bluedome	9.3	0.34	60	2.0	16.6	Loam and gravelly loam.
ID181	4,579	7.2	Zeale-Meegero- Nitchly	16.3	0.19	59	7.3	25.3	Gravelly loam and loam.
ID182	4,196	6.6	Klug- Povey- Lag	44.3	0.13	56	27.8	60.8	Gravelly loam (-50%), very gravelly loam (-30%), and very cobbly loam (-10%). Some stony loam, very stony loam, and unweathered bedrock.
ID183	149,400	233.4	Gany-Zeelnot-Cryochrepts	41.9	0.14	54	25.4	58.4	Gravelly loam (-75%) and a small portion of very stony loam. Some loam, unweathered bedrock, and fragmented material.
ID184	44,950	70.2	Rock Outcrop - Rubble Land - Cryoborolls	52.4	0.04	20	17.2	87.6	Unweathered bedrock, fragmented material and stony loam.

Map Unit ID	Acres	Sq Mi	Name	Ave Slope (%)	Ave K Factor	Ave Depth (in)	Ave Slope Low	Ave Slope High	Soil Texture (Surface)
ID186	55,952	87.4	Zeelnot- Meegernot - Nitchly	30.6	0.15	58	16.4	44.7	Gravelly loam (-75%) and smaller portions of very gravelly loam and very stony loam. Some unweathered bedrock.
ID187	4,622	7.2	Arbus- Fandow- Mountainboy	4.8	0.19	59	1.8	7.9	Gravelly loam (-85%) and a small portion of gravelly silt loam. Some very gravelly loam and unweathered bedrock.
ID189	6,082	9.5	Orthids- Rubble Land- Dacore	50.4	0.10	34	28.3	72.5	Very cobbly loam (-45%) and gravelly loam (-20%). Some stony loam, unweathered bedrock, and fragmented material.
ID194	35,093	54.8	Cryochrepts- Rubble Land- Rock Outcrop	52.4	0.08	32	26.4	78.4	Very stony loam, unweathered bedrock, and fragmented material. Some stony loam, cobbly loam, and gravelly loam.
ID197	24,379	38.1	Chamberlain- Wiggleton- Mountainboy	5.5	0.22	60	2.1	8.8	Gravelly loam (-65%) and gravelly silt loam.
ID198	18,428	28.8	Zer- Sparmo-Lien	17.0	0.26	60	8.0	26.0	Gravelly loam, silt loam, and gravelly fine sandy loam.
Total	616,366	963.1							

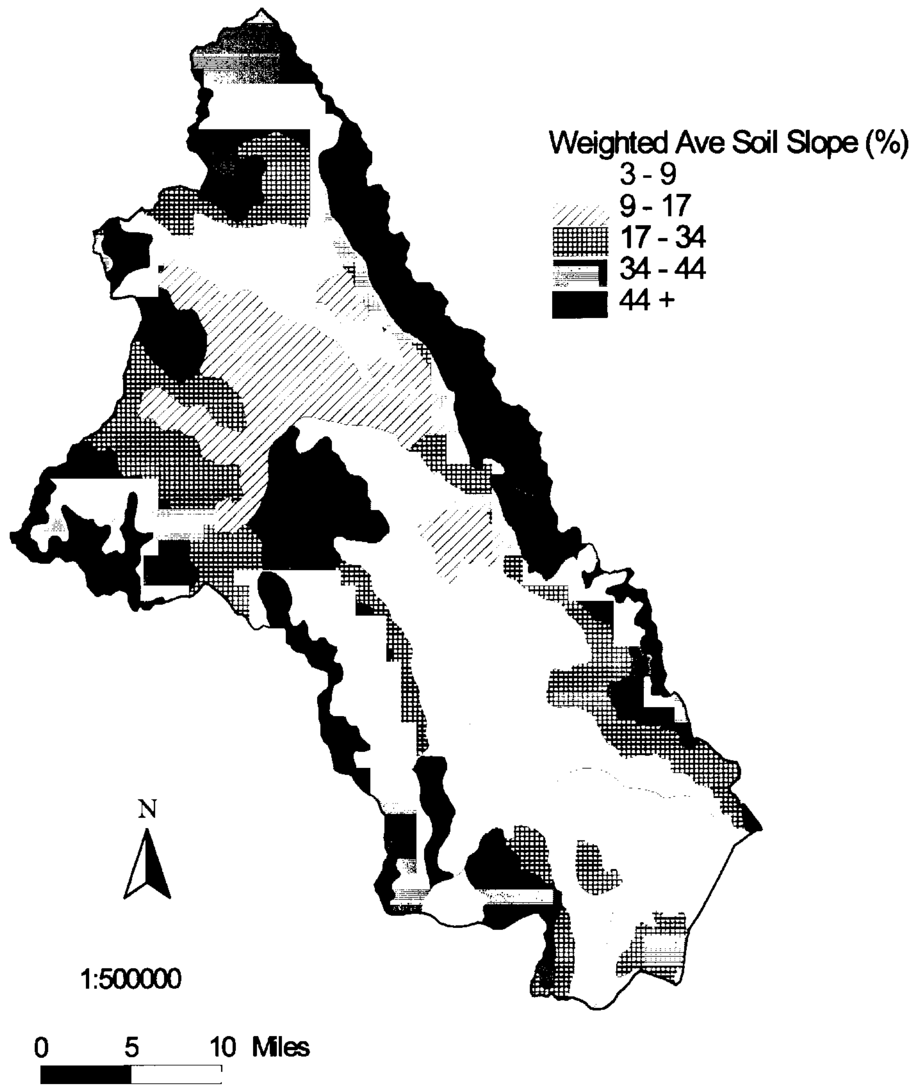
Slopes, K factor and depth are weighted averages (by compfrac) of values in layer.dbf for layer=1 joined with comp.dbf

Figure 4. - STATSGO Soil Map Unit Identifications



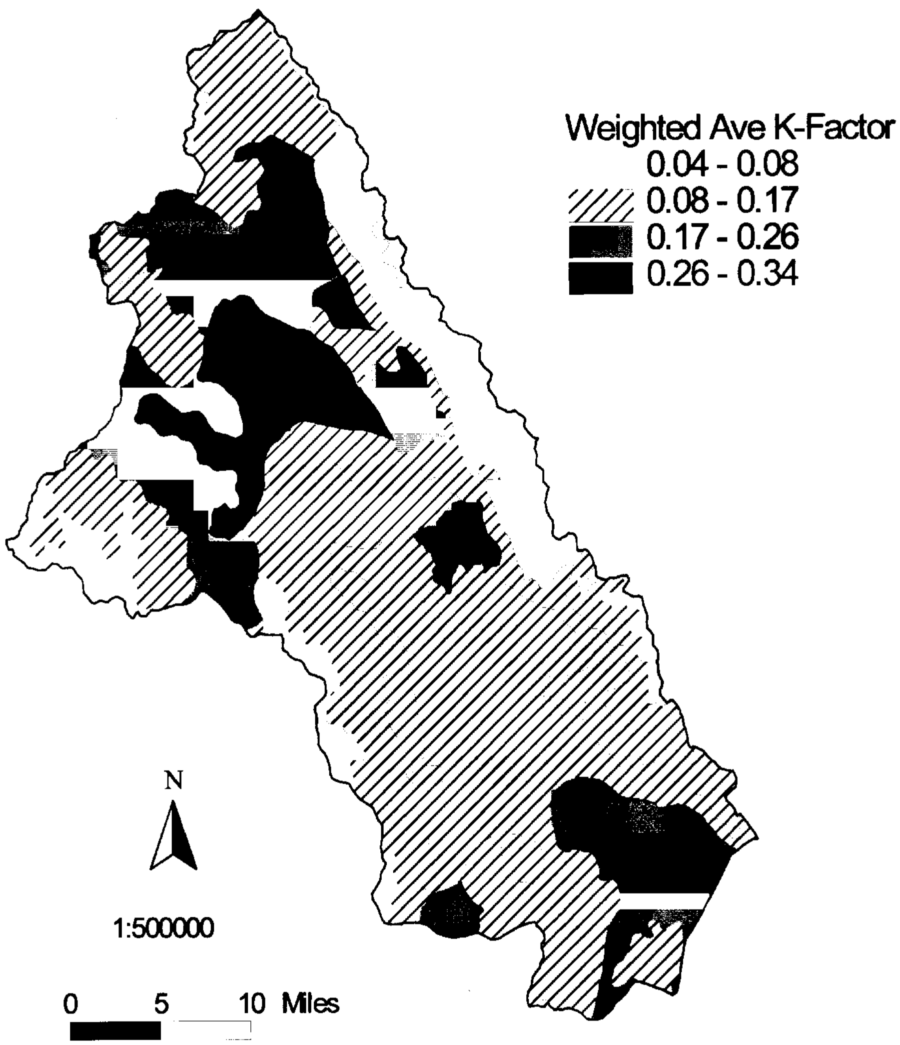
Little Lost River Subbasin - 4th Field HUC

Figure 5. - Soil Slope



Little Lost River Subbasin - 4th Field HUC

Figure 6. - Soil Erosion Potential



Little Lost River Subbasin - 4th Field HUC

1.2. Biological Characteristics

Vegetation

The land cover in the Little Lost River subbasin is predominately forest in the mountain ranges and rangeland in the valley with some irrigated agriculture around Clyde, Fallert, and Howe. In the most northwestern corner of the subbasin, the range of elevation produces a broad spectrum of life zones ranging from semi-arid shrub lands to alpine rock/scree. Several vegetation types are present, including sagebrush and grass, mountain mahogany, spruce, subalpine fir, whitebark pine, and Douglas-fir. In the South Lost River Management Area of the Challis National Forest the vegetative types include sagebrush and grass, and mountain mahogany at the lower elevations with an abrupt transition to Douglas-fir and whitebark pine at higher elevations. A few drainages hold minor amounts of commercial timber, but the quality is poor. The area is classified as part of the western spruce/fir forest ecosystem.

In Sawmill Canyon, vegetation includes sagebrush, grass communities, lodgepole pine, Douglas-fir, subalpine, and mountain mahogany. The area is classified as a sagebrush steppe and western spruce/fir ecosystem (USFS 1987). Moving toward the mouth of Sawmill canyon, the riparian vegetation shifts to balsam poplars, river birch, willows, and crested wheat grass. As the river enters the valley near Summit Creek, the vegetation changes to a mixture of sagebrush, rabbit brush and grasses (Andrews 1972). The area to the east of Howe, the Arco Hills, is classified as a sagebrush steppe ecosystem. The higher elevations are characterized by more gentle sagebrush/grass covered slopes interspersed with stringers of Douglas-fir and whitebark pine (USFS 1987).

Fisheries

Few fish have had access to the Little Lost River drainage due to ancient geological formations which limit overland connections between these streams and adjacent drainages. Some species in the basin are plainly introduced while other species may be naturally established from when the Little Lost River drainage was linked to the Salmon River and Snake River drainages. Eight species of salmonids have been reported to be native or have been introduced into the Little Lost River basin (BLM 1998, USFS 1997, Gamett 1998). These are rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), bull trout (*S. confluentus*), cutthroat trout (*O. clarki*), brown trout (*Salmo trutta*), golden trout (*O. aquabonita*), mountain whitefish (*Prosopium williamsoni*) and Arctic grayling (*Thymallus arcticus*). The subbasin also contains shorthead sculpin (*Cottus confusus*), a native species.

Fish introductions in the drainage have been considerable and date back to 1915. Some species known to have been introduced in the drainage – golden trout, mountain whitefish, and grayling – have not been documented in any streams (Gamett 1998). Hubbs and Miller (1948) report native salmonids of the basin to include bull trout and cutthroat trout. Andrews (1972) also reports mountain whitefish as an native salmonid. Rainbow trout are potentially native to the Little Lost

River subbasin, if the “headwater capture” theory of native species distribution is factual (Corsi and Elle 1989).

Other introductions are clearly exotic. According to Gamett (1998) introduced species in the Little Lost River drainage include guppy (*Poecilia reticulata*), green swordtail (*Xiphophorus helleri*), convict cichlid (*Cichlasoma nigrofasciatum*), Mozambique tilapia (*Tilapia mossambica*), and goldfish (*Carassius auratus*). All five of these have been identified in Barney Hot Springs in the Summit Creek drainage.

Hybridization of species has also been reported (Gamett 1998) in the Little Lost River basin, between rainbow and cutthroat trout as well as brook and bull trout. (The species names used in this discussion were taken from Robins and others 1991.)

Bull Trout

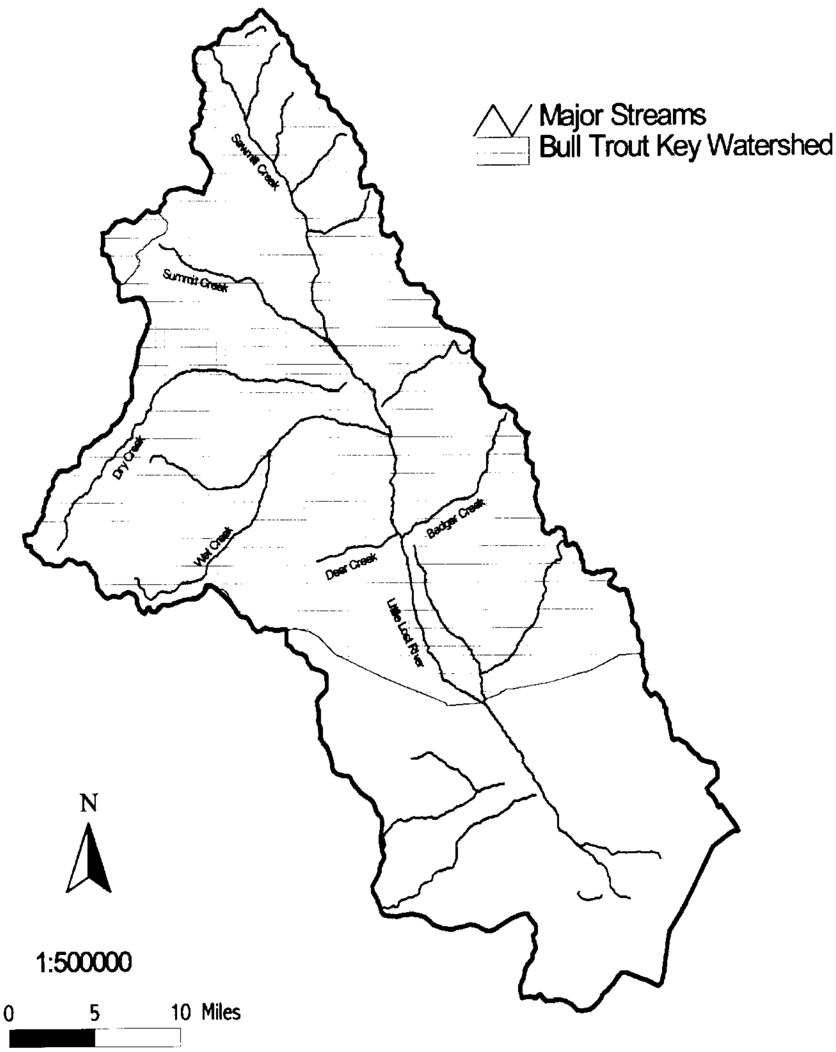
The Little Lost River drainage upstream of the Big Springs Creek confluence is one of 59 key watersheds identified in Governor Batt’s State of Idaho Bull Trout Conservation Plan (Batt 1996). Figure 7. shows the location of the key watershed which covers the northern section of the subbasin and ends around Fallert. Gamett (1998a) reports that bull trout have a wide, fragmented distribution throughout the drainage. Bull trout have been reported in the upper reaches of Badger Creek and Big Creek, the lower reach of Camp Creek, Hawley Creek, Iron Creek, Jackson Creek, the mid- and upper reaches of the mainstream (including Sawmill Creek), Mill Creek, Quigley Creek, Redrock Creek, Smithie Fork, Timber Creek, Squaw Creek (Sawmill Canyon), North Fork Squaw Creek, lower Slide Creek, the upper reach of Warm Creek, Wet Creek (except the mid-section), and Williams Creek.

1.3. Cultural Description of Little Lost River Subbasin

The area in and around the Little Lost Valley is entirely rural with an economy based on agriculture. Grazing of cattle and sheep is the principal agricultural activity, including irrigated pasture and hay to support these animals through the winter. Approximately 9,000 head of cattle and 10,000 head of sheep graze in the subbasin according to recent estimates (BLM, USFS personal communication). In the lower half of the subbasin there is some irrigated cropland, principally alfalfa and small grains. Diversion of surface water for irrigation dates back to the 1870s and has been supplemented by pumping of groundwater since 1948 (IDWR 1998). Currently more acreage is sprinkler irrigated than gravity irrigated (Brennan and others, 1997).

Howe, with a 1990 population of 20, is the largest community. Based on 1990 census data, the Environmental Protection Agency (EPA) estimates a population of 325 in the entire subbasin (EPA Surf Your Watershed). There are less than 0.5 persons per square mile, making this area one of the least populated areas in Idaho, outside of designated wilderness. In many respects the Little Lost Subbasin is the closest thing to a modern day frontier. Over 90% of the land area is publicly owned with the USFS and BLM being the two principal land management agencies.

Figure 7. - Bull Trout Watershed



Little Lost River Subbasin - 4th Field Huc

Butte County's population declined by 12.7% between 1980 and 1990, largely due to emigration, but had risen 3.1% by 1995 (IDC 1998). The Idaho National Engineering and Environmental Laboratory (INEEL) enters the southern fringe of the subbasin and is the largest single employer in the area.

1.3.1. Land Use/Cover

About 70% of the subbasin is considered rangeland (Table 2.). Figure 8. shows the wide distribution of rangeland throughout the subbasin particularly in the valley. The second major land cover is evergreen forest and mixed forest land at 17%. These forested areas are scattered with shrub and brush rangeland throughout the two mountain ranges. A small percentage of the land, about 6%, is used for cropland and pasture. These areas are mainly located in the valley near Howe, Fallert and Clyde. The remaining land cover in the subbasin is principally a mixture of alpine tundra and bare ground.

Road densities are very low in the subbasin. The Little Lost/Pahsimeroi highway is the main paved road through the valley. There are several unpaved roads, developed by BLM, that cross the valley. Most of the unpaved roads located in Sawmill Canyon were developed by the USFS.

Table 2. Land use characteristics in the Little Lost River Subbasin (Anderson Level 2)

Land Use Category	Acres	Sq Miles	Sq Km	% of Total
Transportation, communication, utilities	162	<1	1	<1%
Cropland and pasture	39,249	61	159	6%
Confined feeding operations	102	<1	<1	<1%
		<1	<1	<1%
Herbaceous rangeland	35,385	55	143	6%
Shrub and brush rangeland	116,521	182	472	19%
Mixed rangeland	279,628	437	1,132	45%
Evergreen forest land	91,396	143	370	15%
Mixed forest land	10,189	16	41	2%
Reservoirs	22	<1	<1	<1%
Nonforested wetland	2,246	4	9	<1%
Bare exposed rock	851	1	3	<1%
Strip mines	123	<1	<1	<1%
Shrub and brush tundra	6,389	10	26	1%
Herbaceous tundra	9,891	15	40	2%
Bare ground	21,131	33	86	3%
Mixed tundra	3,028	5	12	<1%
TOTAL	616,375	963	2,494	100%

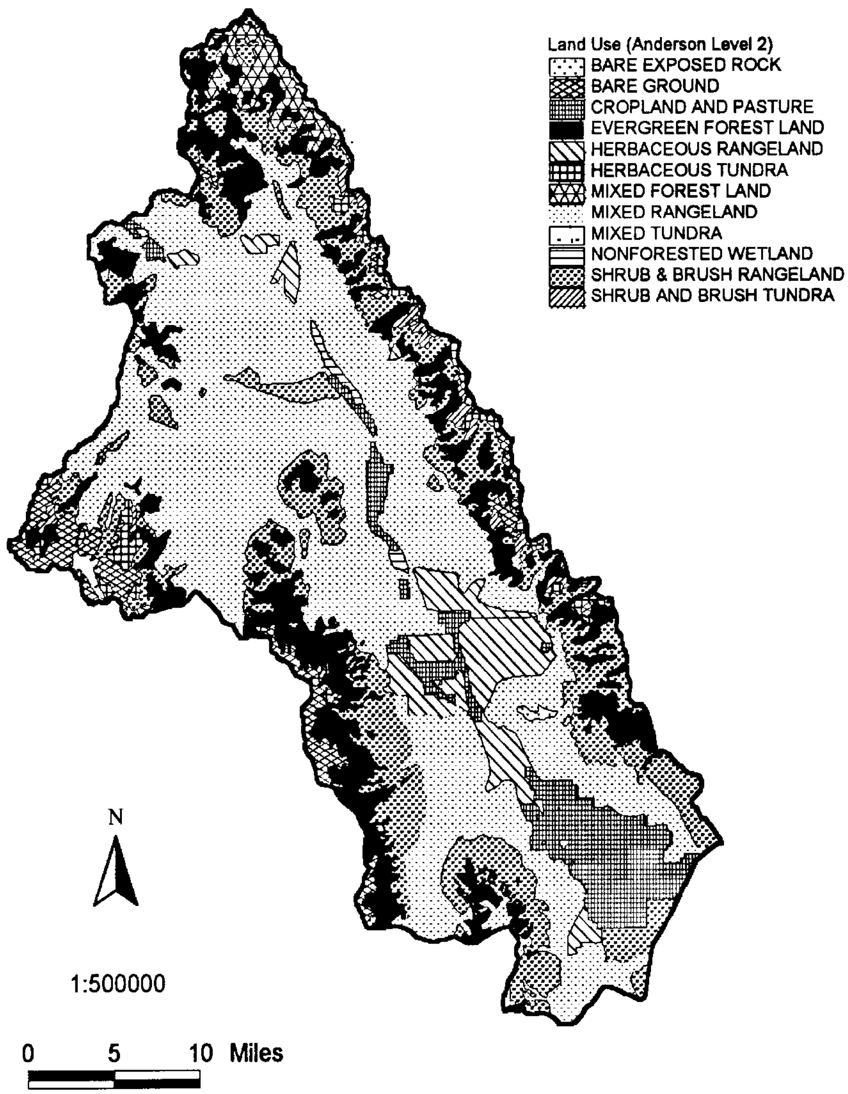
1.3.2. Land Ownership

Most of the subbasin falls within Butte County although Custer and Lemhi Counties divide the northern section. A small percentage of the land in the subbasin is privately owned. Table 3. shows that 91% of the land ownership is public with the majority managed by BLM (43%) and the USFS (43%). As seen in Figure 9., the federal boundaries of Idaho National Environmental Engineering Laboratory (INEEL) enter the subbasin at the southern tip. The State of Idaho (Idaho Department of Lands) manages small land parcels interspersed within BLM land.

Table 3. Land Ownership in the Little Lost River Subbasin

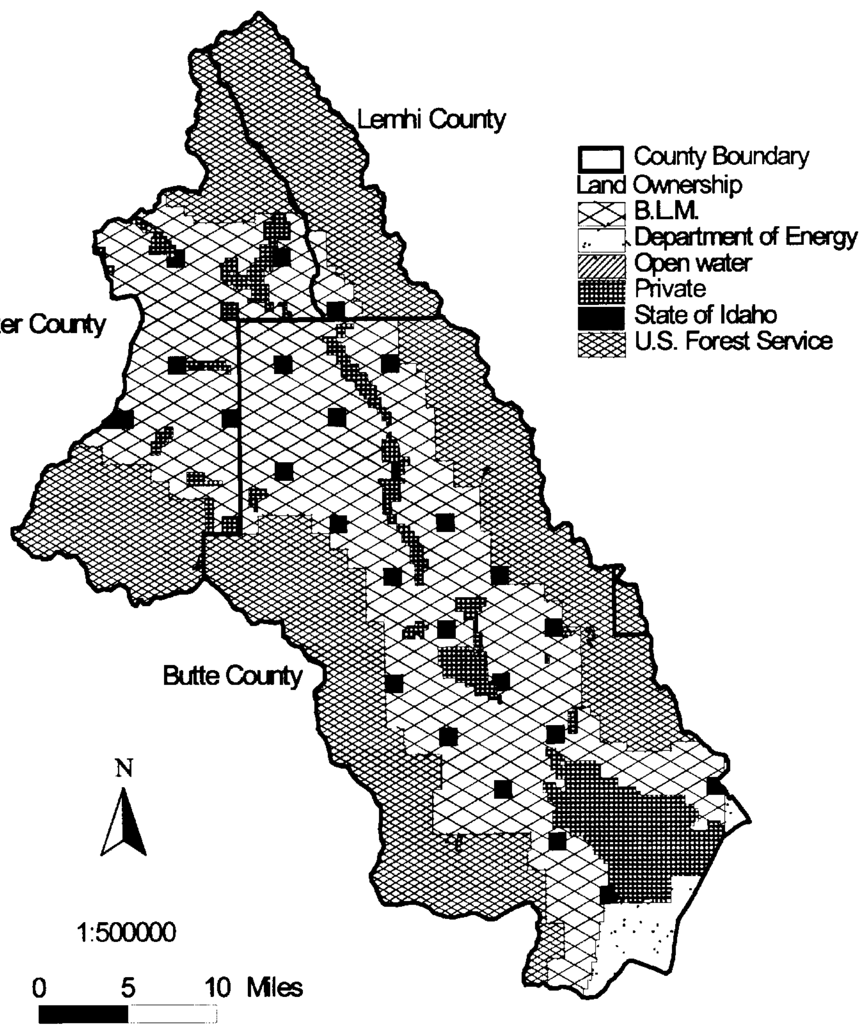
Category	Acres	Sq Miles	Sq Km	% of Total
Private	**54,069**	**84**	**219**	**9%**
Public				
USFS	265,899	415	1,076	43%
BLM	266,454	416	1,078	43%
State of Idaho	15,752	25	64	3%
Department of Energy	14,105	22	57	2%
Open Water	97	<1	<1	<1%
Sub-total	**562,306**	**879**	**2,276**	**91%**
Total	**616,375**	**963**	**2,494**	**100%**

Figure 8. - Land Use (Anderson Level 2)



Little Lost River Subbasin - 4th Field HUC

Figure 9. - Land Ownership



Little Lost River Subbasin - 4th Field HUC

1.4. Watershed Characteristics (5th Field HUC)

The Little Lost River basin has seven subwatersheds or fifth field hydrologic units. Table 4. provides a summary of some watershed characteristics. The table reveals the considerable changes in elevation ranges and corresponding relief ratios. Relief ratio is the difference in elevation between the high point on a watershed divide and its pour point divided by the length of the watershed. This ratio provides a relative indication of watershed steepness and thus, the erosive power of runoff in that watershed. An entirely flat watershed has a relief ratio of zero. Drainage density provides a relative measure of transport efficiency.

Table 4. Physical attributes of 5th field HUCs in the Little Lost River subbasin

HUC5 No.	HUC5 Name	Area (Acres)	Dominant Aspect	Elevation Range		Relief Ratio	Drainage Density mi/mi^2
				Low	High		
1	Lower Little Lost River	141,344	SE	4819	10810	.100-.125	1.19
2	Taylor Canyon	33,557	E	5085	10771	.082	1.40
3	Middle Little Lost River	109,767	SE	5292	10741	.105-.134	1.56
4	Williams Creek	78,262	W-SW	5774	12198	.131-.162	1.26
5	Wet Creek	117,124	NE-E	6171	12139	.052	1.09
6	Summit Creek	62,184	SE	6250	10745	.053	0.75
7	Sawmill Creek	74,138	S-SW	6211	10866	.045	1.13
	Total	616,375					

[1]For mainstem or composite 5th field HUC Nos. 1, 3, 4, relief ratio is calculated based on the width both to the left and right of the mainstem, rather than 'length'.
[2]Drainage density based on 1:100k GIS hydrography, excluding canals and ditches.

For comparable geology and soils, a watershed with greater relief ratio and drainage density would tend to have a greater natural sediment yield as well as higher potential for accelerated erosion due to land surface disturbances.

1.5. Stream Characteristics

Geomorphic characteristics of streams in the Little Lost River drainage vary considerably. Stream elevations in the drainage range from 11,155 feet at the headwaters of Long Lost Creek to approximately 4,790 feet at the terminus of the Little Lost River. Table 5. contains a summary of geomorphic characteristics of major streams in the drainage. The table is organized using the DEQ water body index (Zaroban 1997). Each stream or stream segment identified in the table is the main stem of the water body. The valley and channel classifications are based on Rosgen (1996) and were compiled from U.S. Bureau of Land Management (BLM), DEQ and USGS data. Dominant substrate classifications were compiled from BLM and DEQ data. The overall stream gradient (headwaters to mouth) was calculated from USGS Arco (1988), Borah Peak (1980), and Circular Butte (1980) 1:100,000 scale topographic maps and Idaho Department of Water Resources (IDWR) 1:100,000 scale hydrographic GIS coverage.

Table 5. Geomorphic characteristics of streams in the Little Lost River basin

Stream	WBID No.	HUC5 Name	Rosgen Valley Type	Rosgen Channel	Dominant Substrate	Overall Gradient (%)
Little Lost River	1	Lower Little Lost R.	VIII	C4/C5	sand	0.4
Little Lost River	2	Lower Little Lost R.	VIII	C4/C5	sand	1
Big Spring Creek	3	Middle Little Lost R.	VIII	B4/C4	gravel	1
North Creek	4	Middle Little Lost R.	II-III	A		9
Uncle Ike Creek	5	Middle Little Lost R.	II-III	A		7
Big Spring Cr. tribs.	6	Middle Little Lost R.	II-III	C5	sand	9
Little Lost River	7	Middle Little Lost R.	VIII	C5/C6	silt/clay	1
Badger Creek	8	Williams Cr.	II-III	A4	gravel	9
Little Lost River	9	Williams Cr.	VIII	C5/B4	sand	1
Little Lost River	10	Williams Cr.	VIII	C4	gravel	1
Deep Creek	11	Williams Cr.	II-III	Aa+		12

Stream	WBID No.	HUC5 Name	Rosgen Valley Type	Rosgen Channel	Dominant Substrate	Overall Gradient (%)
Sawmill Creek	12	Sawmill Cr.	VIII	F4	gravel	1
Warm Creek	13	Sawmill Cr.	II	Aa+	gravel	13
Sawmill Creek	14	Sawmill Cr.	II	B3	cobble	2
Squaw Creek	15	Sawmill Cr.	II	Aa+	silt/clay	13
Bear Creek	16	Sawmill Cr.	II	A	gravel	9
Main Fork Sawmill Creek	17	Sawmill Cr.	II	A	cobble	6
Timber Creek	18	Sawmill Cr.	II	A		9
Summit Creek	19	Summit Cr.	VIII	C	gravel	1
Dry Creek	20	Wet Cr.	III	C	gravel	2
Dry Creek	21	Wet Cr.	II	B	gravel	4
Wet Creek	22	Wet Cr.	VIII	C	sand	2
Squaw Creek	23	Wet Cr.	III	A		6
Wet Creek	24	Wet Cr.	II-III	A	gravel	7
Deer Creek	25	Williams Cr.	II-III	B	silt/clay	3
Taylor Canyon	26	Taylor Canyon	II-III	A		9
Cedarville Canyon	27	Taylor Canyon	II-III	A		9
Hurst Creek	28	Lower Little Lost R.	II-III	A		9
unnamed diversion	29	Lower Little Lost R.	VIII	D		0.5

2. WATER QUALITY CONCERNS AND STATUS

2.1. Water Quality Limited Segments Occurring in the Subbasin

Six stream segments from the Little Lost River drainage were included on the Idaho 1996 §303(d) list. These stream segments are shown in Figure 12 and their boundaries, reported pollutants and listing basis are also described in Table 6. The basis on which these segments were listed is *The 1992 Idaho Water Quality Status Report* (DEQ 1992). The listing of Wet Creek was also based on the *Water Quality Advisory Working Committee Designated Stream Segments of Concern 1992-1994* (Zaroban 1993).

Cold water biota and salmonid spawning are reported (DEQ 1992) to be partially impaired in all of the segments except Dry Creek from the diversion to Wet Creek. This segment of Dry Creek is reported as not supporting cold water biota and salmonid spawning. These status determinations were based on evaluations of the stream segments. Only the status determination of the lower section of Dry Creek was based on monitoring. This monitoring was conducted prior to 1989 and was not considered in this assessment due to its age.

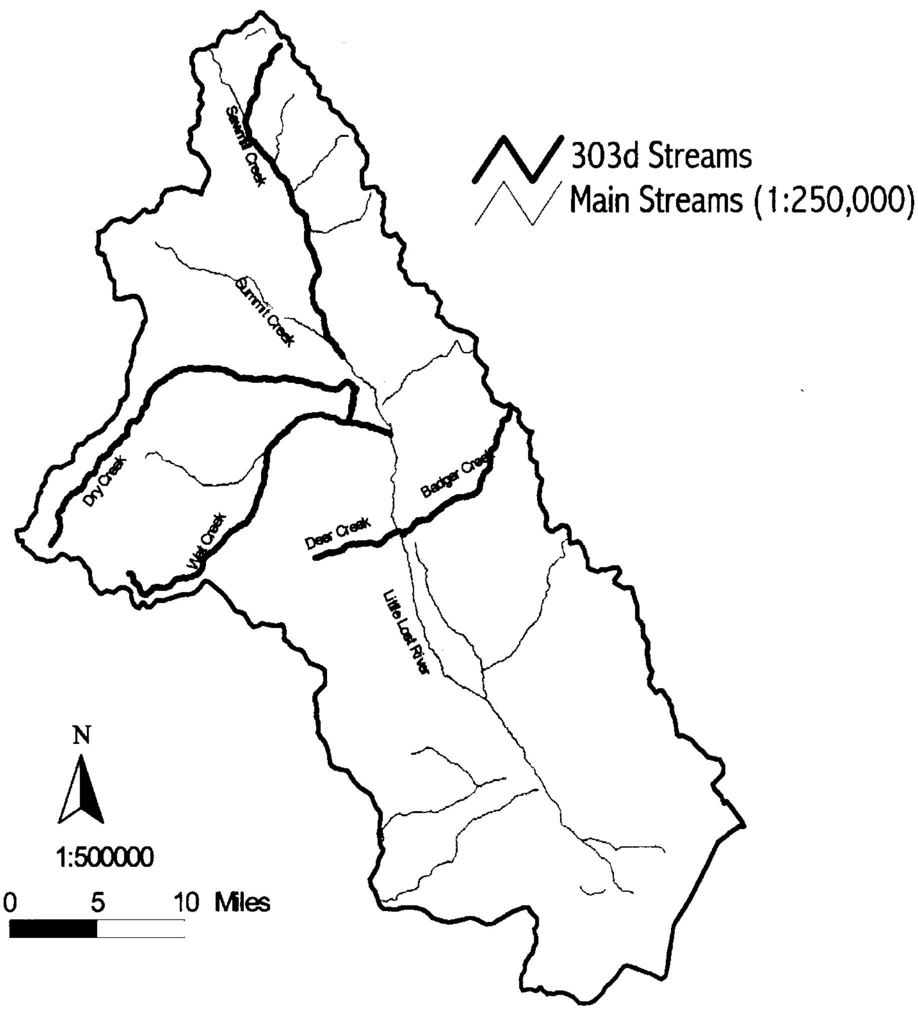
The §303(d) listing of Wet Creek was also based on its designation as an Idaho stream segment of concern in 1992 (Zaroban 1993). Wet Creek was designated as a stream segment of concern due to public concern over agricultural and grazing effects. In the 1992 stream segment of concern nomination process, public concern was also expressed about channel modification of Wet Creek, below the Dry Creek hydropower outflow.

Table 6. 1996 §303(d) streams in the Little Lost River basin

Stream	1996 303 (d) Boundaries	WBID No.	HUC5 No.	Pollutants	Listing Basis
Badger Creek	headwaters to Little Lost River	8	4	nutrients, sediment	1992 305(b) appendix D
Deer Creek	headwaters to Little Lost River	25	4	sediment, flow alter., temperature	1992 305(b) appendix D
Dry Creek	headwaters to Dry Creek Canal diversion (SE, NE, NW, S. 31, T.10N, R.25E)	21	5	sediment, temperature	1992 305(b) appendix D
Dry Creek	Dry Creek Canal diversion (SE, NE, NW, S. 31, T.10N, R.25E) to mouth	20	5	sediment, temperature	1992 305(b) appendix D
Sawmill Creek	headwaters to Little Lost River	12,14, 17	7	sediment	1992 305(b) appendix D

Stream	1996 303 (d) Boundaries	WBID No.	HUC5 No.	Pollutants	Listing Basis
Wet Creek	headwaters to Little Lost River	22,24	5	sediment, flow alter., temperature	SSOC, 1992 305(b) appendix D

Figure 10 - 303(d) Listed Segments



Little Lost River Subbasin - 4th Field HUC

2.2. Applicable Water Quality Standards

The Clean Water Act (CWA) outlines several important goals for protecting the nation's waters. One of these goals is particularly relevant to designated uses. Section 101 (a) (2), the "fishable/swimmable" goals of the CWA, states that:

> "wherever attainable, water quality should provide for the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and on the water."

Most states define designated uses in their water quality standards in the context of : 1) water supplies (public, domestic, agricultural, industrial), 2) recreation in and on the water (primary and secondary contact), and 3) fish (or aquatic life) and wildlife protection. The Idaho Department of Health and Welfare Rules, Title 01, Chapter 02, "Water Quality Standards and Wastewater Treatment Requirements (hereafter referred to a Idaho Water Quality Standards or WQS) currently recognize the following specific use designations:

Water Supply

a. Agricultural (AWS): waters which are suitable or intended to be made suitable for the irrigation of crops or as drinking water for livestock;

b. Domestic (DWS): waters which are suitable or intended to be made suitable for drinking water supplies;

c. Industrial (IWS): waters which are suitable or intended to be made suitable for industrial water supplies. This use applies to all surface waters of the state.

Aquatic Life

a. Cold water biota (CWB): waters which are suitable or intended to be made suitable for protection and maintenance of viable communities of aquatic organisms and populations of significant aquatic species which have optimal growing temperatures below 18EC.

b. Warm water biota (WWB): waters which are suitable or intended to be made suitable for protection and maintenance of viable communities of aquatic organisms and populations of significant aquatic species which have optimal growing temperatures above 18EC.

c. Salmonid spawning (SS): waters which provide or could provide a habitat for active self-propagating populations of salmonid fishes.

Recreation

a. Primary contact recreation (PCR): surface waters which are suitable or intended to be made suitable for prolonged and intimate contact by humans or for recreational activities when the ingestion of small quantities of water is likely to occur. Such waters include, but are not restricted to, those used for swimming, water skiing, or skin diving.

b. Secondary contact recreation (SCR): surface waters which are suitable or intended to be made suitable for recreational uses on or about the water and which are not included in the primary contact category. These waters may be used for fishing, boating, wading, and other activities where ingestion of raw water is not probable.

Currently, Idaho has designated all the major rivers and reservoirs in the state with specific beneficial uses. However, most tributaries to these water bodies are not designated. Undesignated waters are presumed to support cold water biota and primary contact recreation. If specific information indicates other uses existed since November 28, 1975, those existing uses are protected as well. Additionally, industrial water supply, wildlife habitats, and aesthetics are designated for all waters of the state. The Little Lost River was the only water body with specific designated uses identified in the Water Quality Standards (see Table 7.). The subbasin does not have any warm water biota designated uses. Some of the water bodies meet designation requirements for primary or secondary contact recreation according to information provided by the DEQ Beneficial Use Reconnaissance Project (BURP) during the water body assessment process.

Table 7. Little Lost River Subbasin Designated Beneficial Uses.

Water Body	Designated Uses*	1996 §303(d)
Little Lost River (headwaters to sink)	CWB, SS, PCR, SCR, AWS, DWS	
Badger Creek	PCR	T
Deer Creek	SCR	T
Dry Creek (diversion to Wet Creek)	PCR	T
Dry Creek (headwaters to diversion)	PCR	T
Sawmill Creek	PCR	T
Wet Creek	PCR	T
Bear Creek	SCR	
Big Flat Creek U	PCR	
Deer Creek, North Fork	SCR	
Deer Creek, South Fork	SCR	
Garfield Creek	SCR	

Water Body	Designated Uses*	1996 §303(d)
Horse Creek	SCR	
Mill Creek	SCR	
Squaw Creek	SCR	
Summit Creek	PCR	
Warm Creek	PCR	
Williams Creek	SCR	

* CWB-Cold Water Biota, SS-Salmonid Spawning, PCR-Primary Contact Recreation, SCR-Secondary Contact Recreation, AWS-Agriculture Water Supply, DWS-Domestic Water Supply.

Water Quality Criteria

All of the 1996 §303(d) listed streams in the subbasin were listed for sediment. The Idaho water quality standards narrative criteria (IDAPA 16.01.02.200.08) states that sediment shall not exceed, ". . . in the absence of specific sediment criteria, quantities which impair designated beneficial uses." Such impairment is determined through water quality monitoring.

Badger Creek is the only water body listed for nutrients. The narrative criteria (IDAPA 16.01.02.200.06) for nutrients states that surface waters ". . . shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses."

Some of the streams, Deer Creek, Dry Creek (both segments), and Wet Creek, are listed for temperature. The numeric criteria (IDAPA 16.01.02.250) for temperature is found under cold water biota and salmonid spawning. For cold water biota, water temperatures must always be 22EC or less with a maximum daily average of no greater than 19EC. During spawning periods and incubation periods for particular salmonid species (identified in the Idaho water quality standards), water temperature must be 13EC or less with a maximum daily average no greater than 9EC.

The Little Lost River subbasin also contains a key bull trout watershed (see Figure 7.). There are specific numeric criteria for bull trout in the water quality standards (IDAPA 16.01.02.250). For water above 1400 m in elevation water temperatures shall not exceed 12EC daily average during June, July and August for juvenile bull trout rearing, and 9EC daily average during September and October for bull trout spawning. Fifth order and larger rivers are excluded from these criteria.

Deer Creek and Wet Creek are also listed for flow alteration. However, it is Idaho DEQ's position that flow alteration, while it may adversely affect beneficial uses, is not a pollutant per §303(d) of the CWA. There are no Idaho water quality standards for flow, nor is it suitable for estimation of load capacity or load allocations. Because of these practical limitations, TMDLs will not be developed to address flow alteration. For many of the water quality limited waters on Idaho's

§303(d) list, this position will have little effect on implementation plans. This is because concerns which resulted in a listing for flow alteration are often reflected in listed pollutants — sediment or temperature, for example. In such cases, actions taken to address these related pollutants will likely address flow as well. In other cases, alternate control strategies would be applied outside the TMDL process.

2.2.1 Water Column Data

BLM Hydrology Data

In addition to the USGS flow data, discussed in section 1., the BLM has taken instantaneous streamflow measurements on several tributaries to the Little Lost River. (Figure 11.) These data date back to 1989, and were obtained during non-winter months, largely from May through September. The BLM flow data are most extensive for West Creek and Sawmill Creek (Little Lost River above summit Creek) and were collected in association with modifications to grazing management and riparian restoration efforts. These data are most useful for documenting the loss in streamflow in Sawmill Creek below the national forest boundary, and the dramatic increase in flow in lower 7 miles of Wet Creek as a result of the Dry Creek hydroelectric facility.

Andrews (1972) reports an estimated 50% loss in streamflow from Sawmill Creek between the forest boundary and its confluence with Summit Creek. BLM 1989-1997 streamflow data quantify this loss in flow. In forty paired measurements the average percent loss in streamflow was 40% in about a seven mile reach between an upper site (near former USGS station 13117300) and a lower site (about 1 mile below former USGS station 131173600)[1]. Streamflow loss ranged from a high of 96% on 3/19/91, to a low of just 9% on two occasions (4/25/90 & 5/18/94), and is generally higher at lower flows (see Table 8.). The BLM has used these same data to show a trend toward decline in the rate of flow loss (expressed as cfs/mile) corresponding to recovery of the riparian area of lower Sawmill Creek. Apparently the improved riparian condition has provided for less loss of streamflow and higher minimum flows in lower Sawmill Creek. Table 9. also compares the flow measured by BLM in lower Sawmill Creek to uses measured flow at station 13118700.

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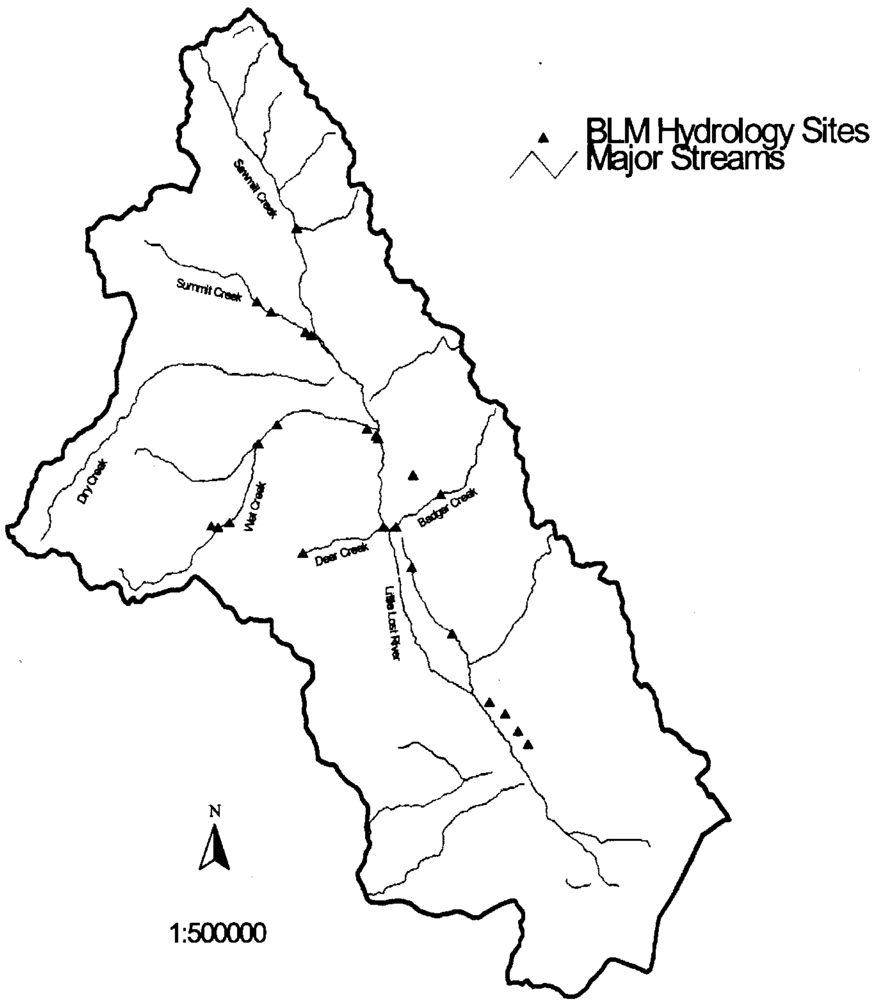
[1]The BLM began monitoring at the USGS gaging site but moved to a location 1 mile downstream in 1996 due to development of a split channel.

Figure 11. - BLM Hydrology Sites



Little Lost River Subbasin - 4th Field HUC

For the same set of dates, flow from Sawmill Creek contributed from 3 to 83% of the flow in the Little Lost River below Wet Creek. This contribution to downstream flow appears to be generally greater during higher flow, but with a great deal of variability likely reflecting variations in conditions of flow prior to actual measurement and fluctuations in the local water table.

Table 8. Streamflow loss in Sawmill Creek

	BLM Upper Sawmill (FS bndry)		BLM Lower Sawmill (@ County Culvert)[1]		Little Lost below Wet Cr. (USGS 13118700)	
Month	**Date**	**Flow (cfs)**	**Flow (cfs)**	**%Loss**	**Flow (cfs)**	**% from Sawmill**
Dec-Feb	no data					
Mar	03/21/90	25.1			48	
	03/19/91	22.0	0.9	-96%	21	4%
Apr	04/25/90	104.0	94.1	-9%	114	83%
	04/23/91	33.9	14.2	-58%	33	43%
	04/22/92	50.9	14.0	-73%	58	24%
	04/13/93	26.1	4.5	-83%	31	15%
	04/18/96	46.8	34.7	-26%	79	44%
May	05/20/91	118.8	98.6	-17%	119	83%
	05/21/92	76.1	59.3	-22%	80	74%
	05/18/94	76.9	70.1	-9%	103	68%
	05/15/95	104.9	75.9	-28%	102	74%
	05/23/96	192.6	136.5	-29%	190	72%
	05/27/97	227.9	181.3	-20%		
Jun	06/06/90	133.0	111.3	-16%	160	70%
	06/10/91	285.7	203.8	-29%	289	71%
	06/18/92	41.5	28.0	-33%	48	58%
	06/29/93	106.8	71.0	-34%	158	45%
	06/23/94	30.7			49	
	06/27/94		16.9		44	
	06/21/95	316.3	218.4	-31%	349	63%
	06/11/96	248.1	171.1	-31%	297	58%
	06/26/96	96.4	59.3	-38%	120	49%
	06/23/97	124.5	85.8	-31%		

	BLM Upper Sawmill (FS bndry)		BLM Lower Sawmill (@ County Culvert)[1]		Little Lost below Wet Cr. (USGS 13118700)	
Month	**Date**	**Flow (cfs)**	**Flow (cfs)**	**%Loss**	**Flow (cfs)**	**% from Sawmill**
Jul	07/02/90	88.3	63.9	-28%	127	50%
	07/08/91	47.7	31.7	-34%	80	40%
	07/15/92	32.8	24.2	-26%	51	47%
	07/21/93	45.8	30.1	-34%	82	37%
	07/11/95	167.6	108.6	-35%	252	43%
	07/27/95	72.1	41.0	-43%	126	33%
Aug	08/22/89	22.6	8.2	-64%	41	20%
	08/13/90	30.8	14.6	-53%	44	33%
	08/27/91	20.3	3.7	-82%	26	14%
	08/19/92	31.9	8.6	-73%	27	32%
	08/16/93	32.2	20.1	-38%	70	29%
Sep-Nov	09/10/90	34.4	20.6	-40%	49	42%
	09/22/92	13.5	10.4	-23%	28	37%
	09/16/93	21.3	13.4	-37%	57	23%
	09/19/95	27.4	11.5	-58%	67	17%
	10/22/90	23.8	18.0	-25%	55	33%
	10/27/92	21.7	15.3	-30%	33	46%
	10/26/93	17.8	13.7	-23%	37	37%
	10/07/96	16.9	6.2	-63%		
	11/08/89	13.4	1.3	-90%	43	3%
	11/09/93	14.5	9.8	-32%	24	41%
Mean	1989-97	76.4	53.0	-40%		
		Diff in mean cfs =		-31%		

[1]The BLM began monitoring at the USGS gaging site but moved to a location 1 mile downstream in 1996 due to development of a split channel.

Water rights records obtained from the IDWR indicate 15 rights on file for diversion of up to 41 cfs from Sawmill Creek. These water rights have not yet been adjudicated so it is unknown whether they are all valid or not. The BLM reports no active diversion of water from Sawmill since riparian restoration efforts began in 1987 (Dan Kotansky, personal communication). Thus the loss of water in Sawmill Creek, by percolation through the streambed into the alluvial aquifer, is natural. Discounting these alluvial losses, streamflow from Sawmill watershed accounts, on average, for 74% of the flow observed in the Little Lost River at the station below Wet Creek (based on 1967-1973 common period of record for gaging stations 13117300 and 13118700).

The phenomenon of losing streams is common in arid to semi-arid areas of the west and also occurs in Summit Creek (Mundorff and others, 1963). Farther to the west, Dry Creek was apparently so named because its entire flow goes subsurface prior to reaching the Little Lost River, except during flood events. This lack of surface connection is depicted in the hydrography of the area and affects the natural distribution of fish.

Further to the south in the Little Lost River subbasin, most of the mountains streams sink into the coarse alluvium of fans at the mouth of canyons and do not contribute surface flow to the Little Lost River. Some, if not all, of this water does resurface as springs and spring fed streams (e.g. Big Springs Creek) further toward the center of the Little Lost valley. It is reported (BLM personal communication) that below Clyde most of the Little Lost River's tributaries are spring fed and show a much flatter annual hydro graph. This contributes significantly to maintaining summer flows and cooler water in the lower Little Lost River between Clyde and Howe.

Data from BLM monitoring of Wet Creek show the dramatic increase in flows in it's lower portion brought about by the addition of flow from Dry Creek discharged through the Dry Creek hydropower plant.

Table 9. Summary of BLM lower Wet Creek flow data 1990-1993

Month	Number of measurements	Wet Creek @ Pass Cr. Road, abv hydro	Wet Creek below Hydropower Plant	% Increase
Apr	2	13.8 cfs	20.0 cfs	38-50%
May	3	24.8	33.6	2-144%
Jun	2	21.8	63.7	122-222%
Jul	2	15.2	51.4	210-260%
Aug	3	13.0	29.5	116-138%
Sep	3	15.5	31.0	78-120%

Water Quality Data Relating to Sediment

Three main sources of data relating to sediment loads in streams in the Little Lost River subbasin were available and evaluated in this assessment. These were BLM hydrology data, DEQ BURP habitat data, and Forest Service depth fines data. The Idaho State University Stream Ecology

Center also provided a Wolman pebble count and embeddedness measurement for one site on Sawmill Creek. In addition to these direct measures of in-stream sediment, BURP macroinvertebrate species data might provide clues to sediment condition. However, little is know at this point about the relative sediment tolerance of various species. Furthermore, in the absence of appropriate reference conditions, the presence or absence of species tolerant of fine sediment does not inform one of whether existing sediment conditions are outside the range of natural variability.

Because Idaho's sediment criteria is narrative, it's application to TMDLs both allows and requires site-specific interpretation of the relation between sediment load and beneficial uses. Although a traditional load capacity envisions a water column concentration as a target, fisheries biologists more typically measure sediment conditions as bed characteristics, e.g. percent fines. This is because such measures relate more directly to effects on the biota but also because they are less variable than water column concentrations and thus more easily quantified. Although they are affected by sediment loading, such surrogate measures as percent fines are not readily related to loads. Site-specific, quantifiable, sediment targets are yet to be determined for the Little Lost River subbasin. The following data largely provides data about existing sediment conditions, very little can be said at this point about departure from expected or desired conditions.

BLM Sediment Data

From 1980 through 1997 the Idaho Falls District of BLM has periodically monitored several streams in the Little Lost subbasin. Their hydrology monitoring consists mostly of streamflow and conductivity measurements with occasional grab sampling for total suspended solids (TSS). Table 10. summarizes this available TSS data for both 1996 §303(d) listed streams and other streams.

Suspended solids loads in streams are naturally highly variable, both temporally - with changes in flow and runoff events, and spatially - depending on soils, landform, and climate of a watershed. Water column data provides only snapshots in time. While simple averages and peaks can be calculated from limited data sets, the chances of estimates accurately portraying the real world is low. More sophisticated measures, such as duration and frequency above or below a threshold are likely, may be more relevant to the biota but require more extensive data. The sparsity of the measurements available makes it difficult to draw any firm conclusions from these data.

In a review aimed at guiding selection of targets for TMDL development, Rowe and others (1998) summarized work done on the effects of suspended solids on aquatic life, particularly fishes. These studies suggest that TSS of 25-80 mg/l is the lower threshold of observable effects. What is unclear from the literature is how to evaluate highly dynamic natural systems against such values. Often the data available do not support anything other than a most simplistic evaluation, such is the case here.

Table 10. BLM Total Suspended Solids Data (mg/l)

Waterbody	Location	Dates	Range	Mean	N
Badger Creek, Upper	**T9N R28E 19 NESW**	**8-13-90 to 5-23-97**	**4-12**	**7.1**	**6**
Lower	**T9N R27E 34 SWSE**	**0**	**5-45**	**24.3**	**6**
Big Creek	T9N R25E 36 NWSW	4-23-80 to 6-12-80	67-125	96	2
Big Springs Upper	T8N R27E 14 NWNE	8-14-90 to 4-24-91	3-7	5	2
Lower	T8N R28E 6 NENE	8-14-90 to 4-24-91	0-17	8.5	2
Deer Creek, Lower	**T9N R27E 33 SWSE**	**8-13-90 to 5-23-97**	**2-18**	**6.5**	**4**
Little Lost, Upper	T9N R27E 4 NWSE	4-23-80 to 6-26-96	19-423	130	8
Sawmill Creek	**just blw bridge near FS bndry**	**8-13-90 to 6-23-97**	**4-52**	**16**	**11**
Sawmill Cr Lower	**near old USGS station 13117360**	**8-13-90 to 6-23-97**	**2-167**	**48**	**14**
Squaw Creek	T9N R26E 8 SENW	4-04-90 to 08-14-90	2-17	9.5	2
Summit Creek	at Sawmill rd x-ing	5-15-95	8		1
	T10N R26E 3 NWNE	4-23-91 to 07-27-95	6-35	20	5
	T10N R26E 2 SWSE	4-22-80 to 06-10-91	14-154	68	4
Warm Springs Cr.	T7N R28E 21 NESE	4-22-80 to 08-14-90	0-217	89	3
Wet Creek #1	**T9N R25E 36 SWSW**	**4-23-80 to 06-11-91**	**6-47**	**22**	**5**
Wet Creek #2	**T9N R26E 31 SWNW**	**4-04-90 to 06-11-91**	**3-27**	**14**	**13**
Wet Creek #3	**T10N R26E 33 SESE**	**4-04-90 to 06-11-91**	**6-97**	**38**	**13**
Wet Creek #3	**T9N R27E 5 NWNE**	**8-14-90 to 06-11-91**	**8-380**	**141**	**3**
Wet Creek #5	**T9N R27E 4 SWNE**	**5-03-95 to 06-23-97**	**10-246**	**90**	**9**

streams in **bold** are on Idaho's 1996 §303(d) list

DEQ BURP Surface Fines

Since 1993, the DEQ has been running BURP to collecting instream biological samples as well as selected physical habitat measures to assess stream health (DEQ 1996a.). Some of the habitat measures relate to stream subtrate. In particular, a Wolman pebble count is conducted to estimate particle size distribution of streambed sediment. These counts entail sampling at least 50 sediment particles per transect at each of three riffles per site. A tally is kept of the size categories into which particles fall based on the intermediate axis diameter. From these data a percentage of particles less than a set category break can be determined, such as the percent surface fines less than 6 mm (small gravel and finer).

A size of 6 mm is often used because many salmonid species prefer particles of this size or greater for spawning and spawning success is diminished when the proportion of finer materials becomes too great. Many researchers have reported a negative correlation between percent fines and salmonid egg survival or aelvin emergence but neither a fixed percent fines threshold nor a consistent size definition for fines can be found in the literature, see reviews of Chapman (1988) and Waters (1995). All that can be said unequivocally is that salmonid egg survival or aelvin emergence seems to be negatively related to the proportion (in the range of 0-50%) of fines below a particle size of 0.8 to 9.5 mm in diameter (intermediate axis). Most of the differences among these studies appears to be due to failure to, or lack of information to, properly stratify results. A single threshold cannot take into account differences in methods or natural variability among salmonid species and streams. Establishment of local reference conditions is important.

Overton and others (1995) do provide some guidance for the expected range of natural conditions for surface fines. They used the R1/R4 fish habitat inventory procedures (Overton and others 1997) which calls for visual estimation of surface fines in the wetted portions of pool tailouts and low gradient riffles, different from DEQ BURP protocol. Their data indicate a mean of 26%, ranging from 0-100%, for streams in the Salmon River basin to the north, with a greater frequency of higher surface fines in volcanic streams. Portions of Wet Creek, Summit Creek, and the western half of Sawmill Creek drain volcanic areas.

The USFS and BLM have recently recommended values for surface fine sediment (<6.0 mm) stratified by channel type and watershed geology (Interior Columbia Basin Ecosystem Management Project 1997). Their recommendations vary from 14% for A channels in metamorphic rocks (e.g. belt series) to 37% for C channels in plutonic rocks (e.g. Idaho batholith)

Surface fines values and related data from DEQ are summarized in Tables 11. and 12., the former deals with 1996 §303(d) streams and the latter with other monitored streams in the subbasin. In evaluating these data it should be noted that Wolman pebble counts are obtained from bankful to bankfull and thus include margins of the streambed not usually underwater and more depositional than the main channel biota normally interact with.

Table 11. DEQ Sediment Data for 1996 §303(d) Streams

Water Body		WBID	Year	Elev. (ft)	Rosgen Channel Type	% Fines <6 mm (1)	% Banks Stable	% Banks Covered
Badger Creek		8	95	7080	B	15	55	72
		8	95	5760	A	41	70	95
Deer Creek		25	95	6360	A	44	70	85
		25	95	6000	B	87	31	98
		25	95	5703	F	74	85	92
Deer Creek	North Fork	25	96	6560	B	67	91	100
	South Fork	25	96	6760	A	82	98	100

Water Body	WBID	Year	Elev. (ft)	Rosgen Channel Type	% Fines <6 mm (1)	% Banks Stable	% Banks Covered
Dry Creek (headwaters to diversion)	21	95	7960	B	25	92	72
	21	95	7400	B	36	45	65
Dry Creek (diversion to Little Lost River)	20	95	7200	C	25	52	0
	20	95	6445	C	10	77	0
Sawmill Creek (upper)	17	95	7644	B	32	88	90
Sawmill Creek (middle)	14	ns	----	-	--	--	--
Sawmill Creek (lower)	12	95	6145	C	25	70	35
Wet Creek (upper)	24	95	7135	B	33	82	90
Wet Creek (lower)	22	95	6350	A	47	75	85
Mean					**43**	**72**	**72**

(1) based on Wolman Pebble count of minimum 50 particles at three transects, ns = not sampled

From these tables it can be seen that the range of surface fines in these streams is indeed quite large and that there is little difference between §303(d) listed and unlisted streams in this regard. It is not known whether these levels of fine sediment are within the range of natural variability or instead represent some natural or human-caused (e.g. bank trampling) perturbation. Other DEQ results and fisheries data presented later show most of these streams support cold water biota and salmonid spawning despite seemingly high surface fines. This may indicate existence of refugia, localized areas of more optimal conditions easily missed in sampling yet sufficient to support the full life-cycle of aquatic life, or local adaptation to naturally finer substrate in these streams.

Table 12. DEQ Sediment Data for non-§303(d) Streams

Water Body	WBID	Year	Elev. (ft)	Rosgen Channel Type	% Fines <6 mm (1)	% Banks Stable	% Banks Covered
Barney Creek	19	97	6330	F	89	100	100
Bear Creek	16	96	708	C	43	78	58
Big Creek	24	97	6950	C	54	100	100
Bull Creek	14	97	7080	A	51	67	34
Coal Creek	24	97	7340	A	71	74	86
Garfield Creek	14	96	6680	A	79	73	100
Hawley Creek	14	97	7150	B	56	97	86

Water Body	WBID	Year	Elev. (ft)	Rosgen Channel Type	% Fines <6 mm (1)	% Banks Stable	% Banks Covered
Horse Creek	9	96	6380	A	82	54	100
	9	96	5960	A	86	62	94
Iron Creek	14	97	7380	B	41	82	100
	14	97	7105	B	39	82	95
Jackson Creek	14	97	7500	A	62	99	90
Little Lost River	1,2,7,9	ns					
Little Lost River	10	97	5800	C	34	70	42
Mahogany Creek	12	97	6880	A	56	100	100
	12	97	6820	A	44	92	99
Main Fork Creek	17	97	7680	D	56	96	82
Meadow Creek	12	97	6955	A	85	79	94
Mill Creek	14	96	7480	B	47	88	88
Moffett Creek	19	97	6340	E	83	100	97
Red Rock Creek	18	97	7555	B	51	82	77
Smithie Creek	17	97	7685	B	41	79	55
Squaw Creek (near Wet Creek confluence)	23	97	6535	E	68	94	98
Squaw Creek (Sawmill Canyon)	15	96	7480	A	62	90	94
	15	96	6920	B	54	58	96
Summerhouse Canyon	19		7570	A	61	76	96
	19	97	6750	C	94	99	95
Summit Creek	19	94	6480	B	36	95	92
Timber Creek	18	97	7760	B	51	64	46
	18	97	7235	B	28	89	77
Warm Creek	13	96	6840	B	50	86	100
Williams Creek	9	96	6200	A	80	60	99
Mean					**59**	**83**	**86**

(1) based on Wolman Pebble count of minimum 50 particles at three transects, ns = not sampled

Forest Service Depth Fines

Although much more limited in coverage, perhaps the most relevant sediment data available is the depth fines measurements provided by the Forest Service. It is known that spawning fish have the ability to sweep away a light covering of fine material overlying coarser gravel and for this reason depth fines are often a more biologically meaningful measure than surface fines. Unfortunately, depth fines are also more difficult and costly to measure, thus not as commonly available as surface fines.

The Forest Service has set a forest plan standard of 30% depth fines but is uncertain as to whether such a value is reasonable for all streams it manages in the Little Lost (Forest Plan, Sawmill Watershed Analysis). Such reservations not-with-standing, Badger Creek easily meets this standard, Mill Creek is right at the margin, and Wet Creek appears to be failing, particularly in 1997 (Table 13.). These more robust depth fines data are in fair agreement with the DEQ surface fines as well as biological assessments of these streams.

Table 13. Forest Service Depth Fines Data[1]

Water Body	WBID	Site Description	Percent Fines[1]		
			1995	1996	1997
Badger Creek	8	20 yds abv ford of first 2-track road	18	nd	nd
Mill Creek	14	100 yds below Sawmill Canyon Rd	nd	21	31
Wet Creek	24	0.9 mi above forest boundary	31	28	40
Wet Creek	24	50 yds above old mill diversion site	nd	nd	43

[1] means based on 5 or 6 hoops per site, nd = no data for that year

Nutrients

Badger Creek is the only water body listed for nutrients (1996 §303(d) list). The Salmon-Challis National Forests gathered nutrient data in August 1995 in response to the §303(d) listing. The following is a summary of the results:

Nitrate as Nitrogen:	0.42 mg/l	Orthophosphate:	<0.01 mg/l
Nitrite as Nitrogen:	<0.01 mg/l	Total Phosphorus:	0.02 mg/l
Ammonia as Nitrogen:	<0.05 mg/l		
Total Kjeldahl Nitrogen:	0.15 mg/l		

Idaho's narrative criteria for nutrients states that surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. There is no numeric criteria, however, the USFS lists recommended levels from

Cline (1973) and Mackenthun (1973) in its Watershed Project Monitoring Results. According to Rose and Gallogly, (personal communication) the results indicate that measured levels of nitrate were slightly above the 0.3 mg/l recommended by Cline (1973) to prevent eutrophication. Observed levels of ammonia were low, however. Measured levels of orthophosphate, the form of phosphorus most available for biological uptake, were well below the 0.10 mg/l level recommended by Mackenthun (1973) for streams which do not flow into reservoirs.

2.2.2 Other Water Quality Data

Fish Data Summary

Fish species occurrence and age class structure are considered in this subbasin assessment in order to document the existence and status of aquatic life and salmonid spawning beneficial uses. All species in the water body are considered to assess aquatic life uses (cold water or warm water biota). Species of the family Salmonidae are considered to document salmonid spawning, bull trout spawning, and juvenile bull trout rearing. Fish data used are from Gamett (1998a), locations he sampled are mapped in Figure 12.

Bull trout in the subbasin use both resident and fluvial life-history strategies. Bull trout found in Williams Creek and possibly upper Squaw Creek are resident fish. In the mainstem (including Sawmill Creek) below Iron Creek, the bull trout are fluvial and migrate to headwater streams to spawn. Currently, bull trout appear to use the following tributaries for spawning and/or rearing: Camp, Hawley, Iron, Jackson, Redrock, Smithie Fork, Slide, timber, and Firebox Creeks. (Gamett 1998a) Bull trout densities in Smithie Fork are the highest Gamett has observed anywhere (personal communication).

Five habitat characteristics, channel stability, substrate composition, cover, temperature, and migratory corridors, are considered critical to bull trout (Rieman and McIntyre 1993). Gamett (1998a) reported that bull trout densities have decreased significantly in parts of the subbasin since 1987. Although he mentions several possible reasons for this reduction, he states that high stream temperatures appear to be the most significant factor influencing bull trout distribution in the drainage.

Table 14. summarizes the data available to assess aquatic life and salmonid spawning in the Little Lost River subbasin. The streams listed are the main stem of each water body. Water body numbers were assigned using the Idaho DEQ water body indexing system (Zaroban 1997) (Figures 13 and 14). The entries in the rainbow, brook, and bull trout columns provide the number of reported age classes for each water body and whether young of the year (YOY) were present. An asterisk or text in the cutthroat, shorthead, exotics, and hybrids columns indicate existence in the water bodies. Where no data was available, “NO DATA” is used as the record for the water body.

Cold water species dominate the Little Lost River subbasin except for water bodies that are fed by geothermal water sources, such as Barney Creek in the Summit Creek water body (number 19). All fish species reported to be native in the basin are cold water species. All water bodies from which we had data are considered to have cold water biota as their aquatic life use. The existence of the salmonid spawning beneficial use was determined from rainbow, brook, or bull trout age class structure. Length frequency distributions were not available for cutthroat trout.

Figure 12 - Gamett Fish Sampling Locations

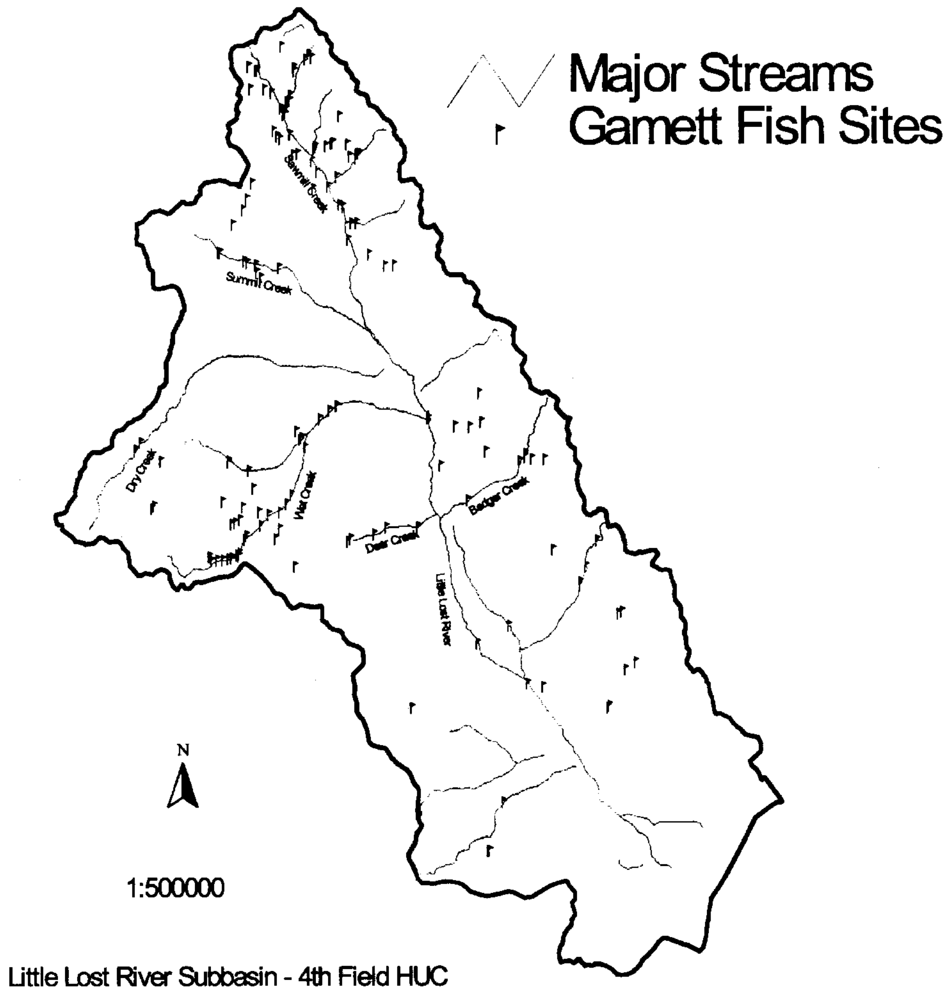


Table 14. Summary of fish species and salmonid age class occurrence in the Little Lost River basin.

Stream	WBID #	Rainbow	Brook	Bull	Cutthroat	Shorthead	Exotics	Hybrids
Little Lost River	1	3/YOY		1				
Little Lost River	2	1						
Big Spring Creek	3	4/YOY	3/YOY	1		*		
North Creek	4	1						
Uncle Ike Creek	5	3	2					
Big Spring Cr. tribs.	6	NO	DATA					
Little Lost River	7	2		1		*		
Badger Creek	8	4/YOY		3/YOY		*		
Little Lost River	9	3	1	3/YOY		*		
Little Lost River	10	4/YOY	2	1		*		
Deep Creek	11	NO	DATA					
Sawmill Creek	12	4/YOY	3/YOY	2		*		*
Warm Creek	13	4/YOY		2/YOY			grayling	
Sawmill Creek	14	5/YOY	3/YOY	4/YOY	*	*		*
Squaw Creek	15	3/YOY	3/YOY	3		*		*
Bear Creek	16	3/YOY						
MF Sawmill Creek	17	3/YOY		5/YOY		*		

Stream	WBID #	Rainbow	Brook	Bull	Cutthroat	Shorthead	Exotics	Hybrids
Timber Creek	18	2/YOY		4/YOY		*		
Summit Creek	19	4/YOY	2	1		*	tropical	
Dry Creek	20	NO	DATA					
Dry Creek	21	1	4/YOY		*			*
Wet Creek	22	3	1	2				*
Squaw Creek	23	3/YOY		1	*	*		*
Wet Creek	24	5/YOY	4/YOY	5/YOY		*		*
Deer Creek	25	4/YOY				*		
Taylor Canyon	26	NO	DATA					
Cedarville Canyon	27	NO	DATA					
Hurst Creek	28	NO	DATA					
unnamed diversion	29	NO	DATA					

Figure 13 - DEQ Water Body I.D. (WBID) Boundaries

Upper Portion of the Little Lost River subbasin - 4th Field HUC

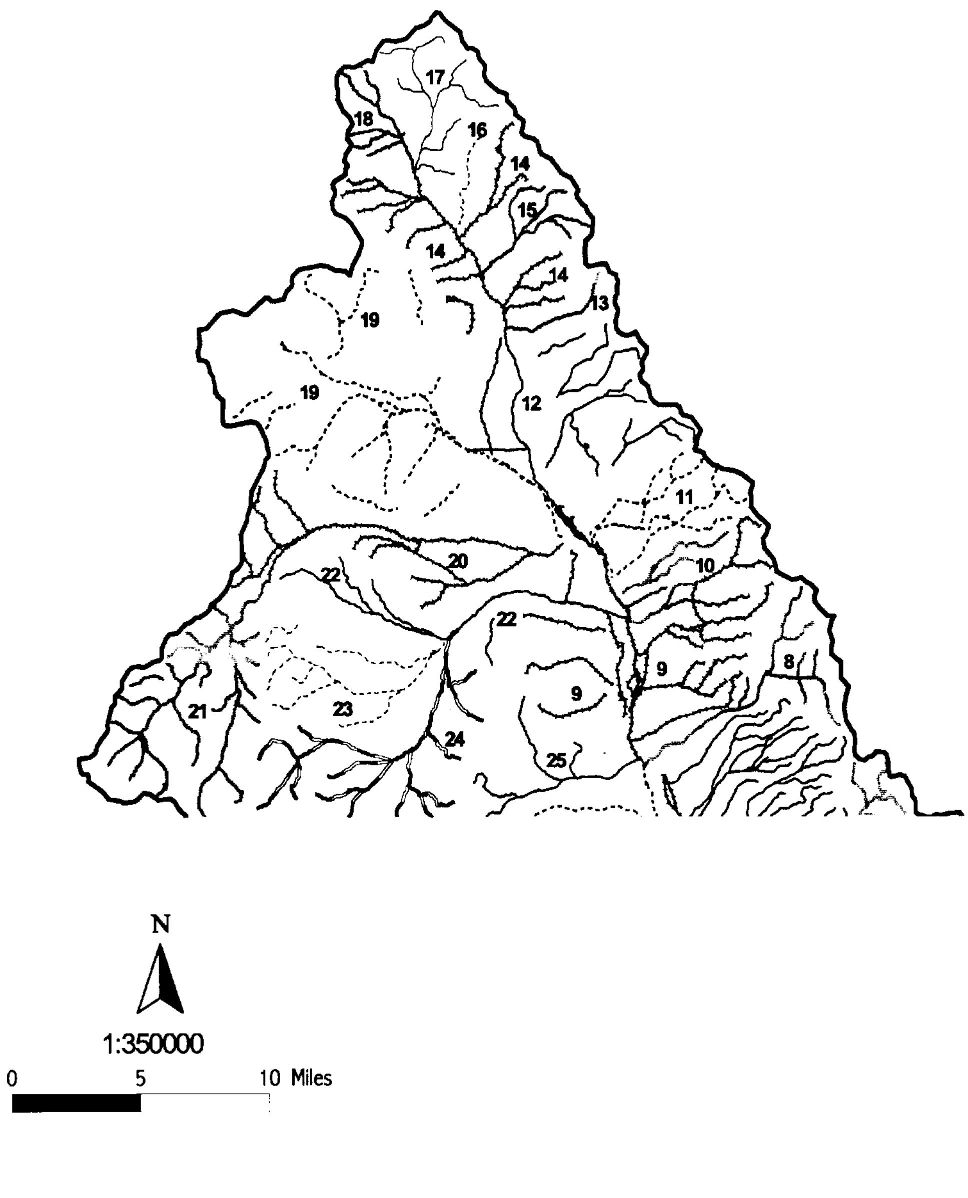
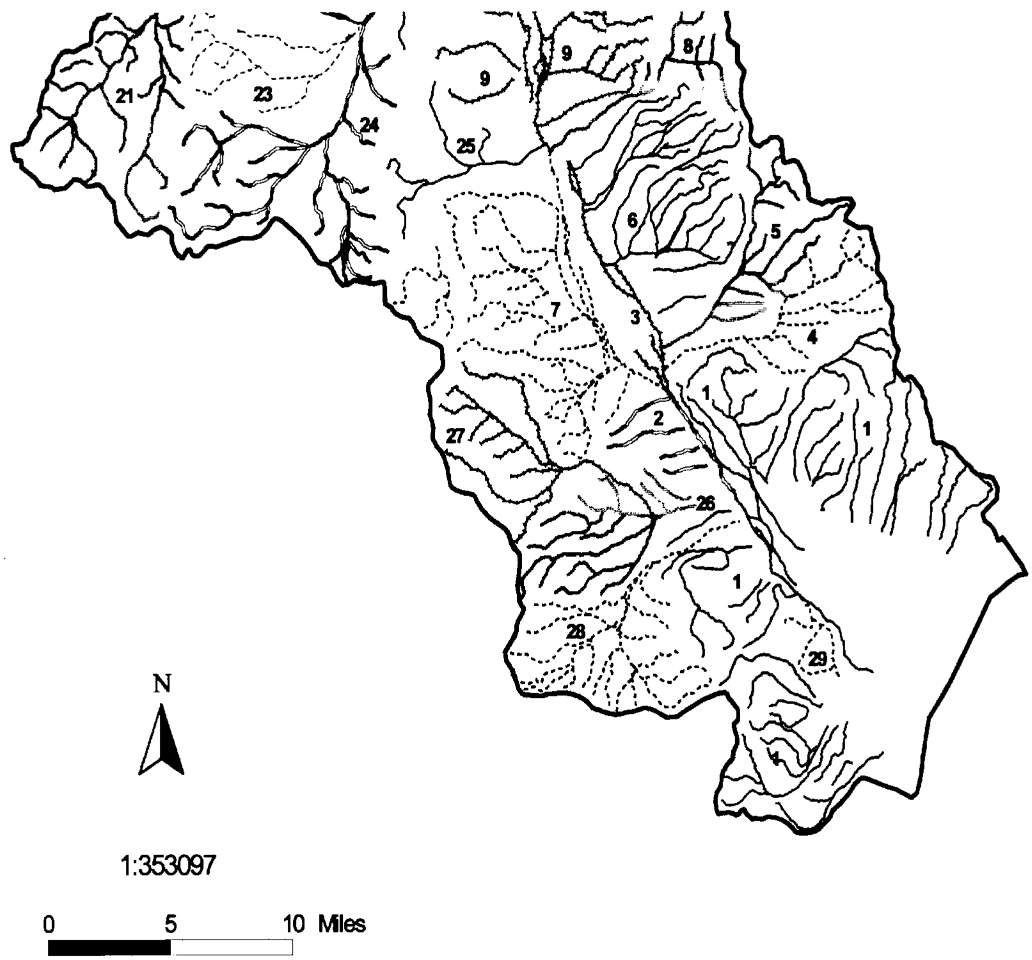


Figure 14 - Water Body I.D. (WBID) Boundaries

Lower Portion of the Little Lost River Subbasin - 4th Field HUC



Aquatic life and salmonid spawning based on fish data

All of the water bodies in the Little Lost River basin for which we had fish data (22 out of 29) contain cold water fish species. The only reported exceptions to this occur in Barney Creek and Barney Hot Springs (tributary to Summit Creek, water body number 19) where five species of aquarium fish occur (Gamett 1998). All of the native fish are cold water species (Zaroban and others in preparation). Based on the fish data we used in this assessment, cold water biota is the aquatic life use in the Little Lost River basin with the exception of the hot springs.

The evaluation of salmonid spawning is based on rainbow trout, brook trout, and bull trout occurrences in the Little Lost River basin. Seventeen water bodies contain at least one salmonid species with multiple year classes, including young of the year (note Table 15.). Three water bodies (numbers 5, 7, 22) contain multiple age classes of at least one salmonid species, but did not have any documentation of young of the year. Two water bodies (numbers 2 and 4) contained but one salmonid species and only one age class was documented of that species. We had no length frequency data available from the remaining seven water bodies.

Table 15. Little Lost River water bodies containing at least one salmonid species with documented multiple year classes including young of the year.

Water Body	WBID No.	Boundaries
Little Lost River	1	main stem and tributaries from diversion at NE¼, NW¼, Sec. 11, T. 6N, R. 28E to mouth
Big Spring Creek	3	main stem and tributaries from headwaters to Little Lost River
Badger Creek	8	main stem and tributaries from headwaters to Little Lost River
Little Lost River	9	main stem and tributaries from Wet Creek to Badger Creek
Little Lost River	10	main stem and tributaries from Summit Creek to Wet Creek
Sawmill Creek	12	main stem and tributaries from Warm Creek to Summit Creek
Warm Creek	13	main stem and tributaries from headwaters to Sawmill Creek
Sawmill Creek	14	main stem and tributaries from Timber Creek to Warm Creek
Squaw Creek	15	main stem and tributaries from headwaters to Sawmill Creek
Bear Creek	16	main stem and tributaries from headwaters to Sawmill Creek
MF Sawmill Creek	17	main stem and tributaries from headwaters to Timber Creek confluence

Water Body	WBID No.	Boundaries
Timber Creek	18	main stem and tributaries from headwaters to Sawmill Creek
Summit Creek	19	main stem and tributaries from headwaters to Sawmill Creek confluence
Dry Creek	21	main stem and tributaries from headwaters to Dry Creek canal
Squaw Creek	23	main stem and tributaries from headwaters to Wet Creek
Wet Creek	24	main stem and tributaries from headwaters to Squaw Creek
Deer Creek	25	main stem and tributaries from headwaters to Little Lost River

The 17 water bodies where multiple age classes and young of the year were documented averaged 1.6 spawning species in the water body and 3.6 age classes per species. Three age classes including young of the year from at least one salmonid species is the norm for monitored water bodies in the Little Lost River subbasin.

Water body 2 is the Little Lost River, and its tributaries, from Big Spring Creek to the diversion dam at NE¼, NW¼, Sec. 11, T. 6N, R. 28E. One age class of rainbow trout was collected from streams in this water body. No brook trout or bull trout were collected. Six rainbow trout were collected from the Little Lost River 0.5 miles below the Big Spring Creek confluence. These fish ranged in total length from 6.7 to 9.4 inches. Rainbow trout have recently been stocked in Big Spring Creek. Fish stocking records from the Idaho Department of Fish and Game (IFG) show that rainbows have been stocked in Big Spring Creek from 1991 through 1996 (IFG 1998). The proximity of collection to Big Spring Creek and the lengths of the six fish collected in the Little Lost River suggest that these fish may be stocked fish that have moved out of Big Spring Creek.

Water body 4 is the North Creek drainage. One age class of rainbow trout was collected from this water body. No brook trout or bull trout were collected. One rainbow approximately 4 inches in total length was collected from North Creek 0.25 miles above the forest boundary.

Water body 5 is the Uncle Ike Creek drainage. Two sites were monitored on Uncle Ike Creek. Three rainbow trout (representing three age classes) and six brook trout (representing two age classes) were collected at the diversion. Two rainbow trout (representing one age class) and two brook trout (representing two age classes) were collected approximately 1.0 mile above the diversion. No young of the year were collected at either site.

Water body 7 is the Little Lost River and tributaries from Badger Creek to Big Spring Creek. Rainbow trout and bull trout are reported from a monitoring site 0.25 miles below Bird and Buck Road. Eleven rainbows representing two age classes and one bull trout was collected. No young of the year were collected.

Water body 22 is Wet Creek from the Squaw Creek confluence to the Little Lost River. Four sites were monitored in this segment of Wet Creek. Twenty-three rainbow trout (three age classes), two brook trout (one age class), and four bull trout (two age classes) were collected from a site just below the Pancheri diversion. Three rainbow trout (two age classes) and one bull trout were collected from just below the Dry Creek hydroelectric plant. Twenty-four rainbow trout (three age classes) and one bull trout were collected 2.25 miles below Squaw Creek. Twenty-one rainbow trout representing three age classes were collected 1.25 miles below the Squaw Creek confluence. No young of the year from any of these species were collected from any of these sites. By comparison, five age classes of rainbow trout, four age classes of brook trout, and five age classes of bull trout were documented in the Wet Creek drainage above Squaw Creek.

Stream Temperature Data

Thermograph plots of U.S. Forest Service data (Gamett 1998) from 14 sites on seven waterbodies were evaluated for 1994-96 temperature exceedances. Daily average criteria were not assessed for 1994-96 because we did not have the raw data available to calculate daily averages. Six of these sites were monitored in more than one year.

For 1997 raw stream temperature data were obtained for 43 sites on 18 waterbodies. For these data all applicable State of Idaho temperature criteria were evaluated, and also the EPA promulgated Federal criterion for bull trout of 10 °C. This criterion is expressed as an average of daily maximum temperatures over a seven-day period for the months of June through September and applies to specifically named waters in Idaho (Federal Register: July 31, 1997, Vol. 62 No. 147). Figure 15. is a map of the locations for which temperature data were evaluated.

For the purposes of this subbasin assessment, we defined a major exceedance of the cold water biota instantaneous criteria as a maximum of at least 3EC over the criteria and at least 10 days of any exceedance during the period of record. A major exceedance of the instantaneous salmonid spawning criteria was defined as a maximum of at least 3EC over the criteria and at least 10 days of any exceedance during the spawning season of a particular species.

A distinction between major and minor exceedances recognizes that small, short duration exceedances—deemed minor exceedances—are not expected to adversely affect biota. In DEQ's assessment process (DEQ WBAG 1996b.), evaluation of criteria exceedances is reinforced by bio-monitoring data such that if biological data indicate impairment then the waterbody is considered impaired regardless of a major/minor distinction in criteria exceedances.

All of the evaluated stream temperature data has been gathered during an extended period of abnormally warm weather (see Appendix A).

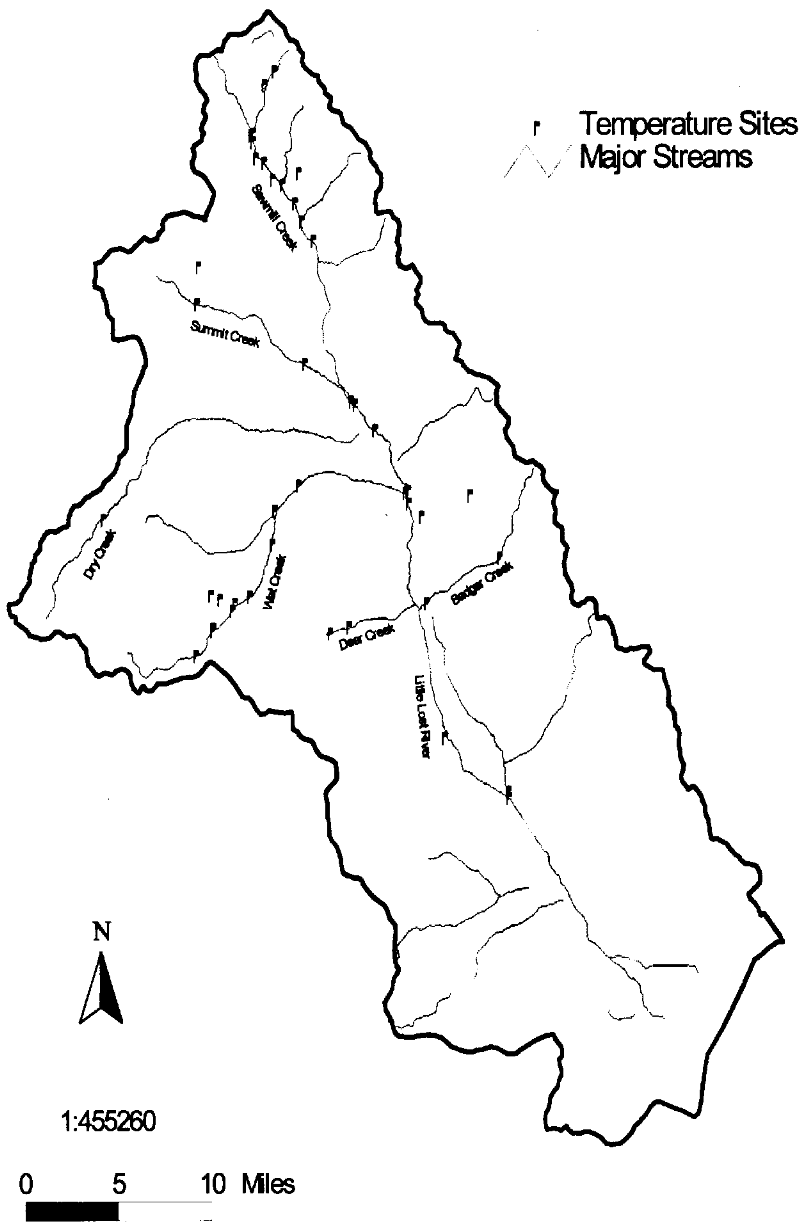
1994-96 Stream Temperatures

Thermograph plots from three water bodies indicated exceedances of the Idaho 22EC instantaneous aquatic life temperature criterion. Exceedances were recorded in lower Sawmill Creek (WB12) in 1994 and 1995, Summit Creek (WB19) in 1995 and lower Wet Creek (WB22) in 1994 from two locations (Table 16). A major exceedance of the cold water biota instantaneous criteria was recorded in lower Sawmill Creek during 1994.

Table 16. Exceedances of the 22EC cold water biota instantaneous temperature criterion.

Stream	WBID	Days/Yr	Max. # of EC Over	Date of Max. Exceed.
Sawmill Creek near Summit Creek	12	3	1	3 Sep 95
Sawmill Creek near Summit Creek	12	25	5	23 Jul 94
Summit Creek at county line	19	9	1	28 Jun 95
Wet Creek at Clyde	22	3	1	22 Jul 94
Wet Creek at Deer Creek road crossing	22	2	<1	20 Jul 94

Figure 15. - Temperature Sites



Little Lost River Subbasin - 4th Field HUC

Thermograph plots from seven water bodies indicated exceedances of the Idaho 13EC instantaneous salmonid spawning temperature criterion. Exceedances were recorded in the Little Lost River below Big Spring Creek (WB2), Little Lost River at Clyde (WB9), lower Sawmill Creek (WB12), middle Sawmill Creek (WB14), Summit Creek (WB19), lower Wet Creek (WB22), and Big Creek (WB24).

Major exceedances of the Idaho 13EC salmonid spawning instantaneous temperature criterion are summarized in table 17. A more detailed summary of duration and magnitude 1994-1996 instantaneous criterion exceedances can be found in Appendix C, 1994-96 Salmonid Instantaneous Temperature Criteria Exceedances.

Table 17. 1994-96 exceedances of the salmonid spawning 13°C temperature criterion

Major[1] exceedance in			Species[2]	WBID	Description of Location
1994	1995	1996			
T	T		rb	2	Little Lost R. below Big Springs Creek
T	T		rb & bu	9	Little Lost River @ Clyde
T	T		rb & bu	12	Sawmill Creek near Summit Creek
T	T		rb & bu	14	Sawmill Creek @ forest boundary
				14	Mill Creek @ trail head
				14	Iron Creek just above Iron Cr. road
				14	Sawmill Creek below Timber Cr.
				14	Sawmill Creek below Iron Cr.
	T		rb & bu	19	Summit Creek @ county line
T	T		rb & br & bu	22	Wet Creek @c Deer Cr. road x-ing
T			rb	22	Wet Creek @ Clyde
	T			24	Big Creek just above Wet Cr.
				24	Wet Creek 0.8 km above Hilts Cr.
		T	rb	24	Wet Creek @ forest boundary

[1] A major exceedance is defined as 10 or more days of exceedance of the 13° C instantaneous criterion or a single exceedance of that criterion by more than 3 °C. [2] Species for which major exceedance occurred; rb = rainbow trout, br = brook trout, bu = bull trout. Checked cells indicate major exceedance for one or more species, grayed cells indicate no data, blank cells indicate no major exceedances for species present.

1997 Stream Temperatures

Table 18. summarizes major temperature criteria exceedances based on analysis of 1997 continuous temperature data obtained from the Challis-Salmon National Forest.

Table 18. 1997 temperature criteria exceedances

Major[1] exceedance of							Sampling Site	Description of Location
CWB		SS		bull trout				
I	D	I	D	J	S	E		
							BADG@FS	Badger Creek at BLM/FS boundary
		T	T		T	T	BADG@RD	Badger Creek at Little Lost/Pahsimeroi Rd.
T		T	T	T	T	T	BASIN	Basin Creek about 50 meters above Wet Cr.
		T	T	T	T	T	BEAR	Bear Creek about 50 m above Sawmill Cr.
						T	BIG@POND	Big Creek about 100 m below Big Cr. Pond
		T	T			T	BIGCR@RD	Big Creek at Wet Cr./Pass Cr. Road
		T	T			T	BIGCREPP	Big Creek at FS/private land boundary
		T	T		T	na	BIGSPR@S	Big Springs Creek at BLM/ private bndry near source
		T	T	T	T	na	BIGSPRIL	Big Springs Creek about 100 m above Little Lost R.
		T	T	T	T	T	COAL	Coal Creek about 10 m above Wet Creek
		T	T	T	T	na	DEER@CON	Deer Cr. about 200 m below confluence N & S Forks
		T	T	T	T	na	DEER@PA	Deer Creek at private/BLM boundary
						T	DRY@FSBO	Dry Creek at Forest Service boundary
		T	T	T	T	na	FALLERT	Fallert Springs Cr. about 100 m above Little Lost R.
						T	IRON	Iron Creek about 5 m above Sawmill Creek
		T	T	T	T	T	LLABOWET	Little Lost River about 500 m above Wet Cr.
		T	T	na	na	na	LLBEBGSP	Little Lost River below Big Springs Cr. (intersection with road #124)
		T	T	T	T	na	LLR@BN'B	Little Lost River at Buck n' Bird Road (#582)
					T	T	MILL	Mill Creek about 100 m above Sawmill Cr.
			T		T	T	SAW@BULL	Sawmill Creek at Bull Creek Road (#103)
		T	T	T	T	T	SAW@FSBO	Sawmill Creek at Sawmill Canyon Road (#101), about 800 m below FS boundary
		T	T	T	T	T	SAWABOSU	Sawmill Creek about 100 m above Summit Creek
						T	SAWABSMI	Sawmill Creek about 1.5 km above Smithie Fork
						T	SAWATIM	Sawmill Creek about 200 m above Timber Creek
						T	SAWBETIM	Sawmill Creek about 400 m below Timber Creek
		T	T	T	T	T	SAWBMI&S	Sawmill Creek about 500 m below Horse Lake Creek
			T			T	SMITHIE	Smithie Fork about 100 m above Sawmill Cr.
		T	T		T	T	SQUA(WET	Squaw Creek about 75 m above Wet Creek
		T	T		T	T	SQUAW(SA	Squaw Creek about 10 m above Sawmill Creek
		T	T	T	T	T	SUM@IRON	Summit Creek about 200 m below Iron Springs

Major[1] exceedance of							Sampling Site	Description of Location
CWB		SS		bull trout				
I	D	I	D	J	S	E		
		T	T	T	T	T	SUM@SCRO	Summit Creek at BLM/private land boundary downstream of Sawmill Canyon Road crossing
		T	T	T	T	T	SUMABLLR	Summit Creek about 100 m above Sawmill Creek
		T	T	T	T	T	SUMMERHO	Summerhouse Canyon Cr. about 1.5 kilometers below FS boundary
						T	TIMBER@C	Timber Creek about 50 m above Sawmill Creek
		T	T	T	T	T	UNNAMWET	unnamed tributary to Wet Creek about 200m below Coal Creek, 20 m above mouth
		T	T		T	T	WET@FSBO	Wet Creek at Forest Service boundary
		T	T	T	T	T	WET@DCRR	Wet Creek at Deer Creek Road (#278) crossing
		T	T	T	T	T	WETABHYD	Wet Creek about 100 m above Dry Cr. hydro inflow
		T	T	T	T	T	WETABLLR	Wet Creek about 200 m above Little Lost River (at Little Lost/Pahsimeroi Road crossing)
		T				T	WETBESMI	Wet Creek about 300 m above Coal Creek
						T	WETINMEA	Wet Creek about 800 m above Hilts Creek
			T		T	T	WILLIAMS	Williams Creek about 3.5km below FS boundary
							WILLUPPE	Williams Creek about 1.6 km above FS boundary

[1] A major exceedance is defined as 10 or more days of exceedance of a particular criteria or a single exceedance of a criteria by more than 3 °C. CWB = cold water biota, SS = salmonid spawning, I = instantaneous, D = daily average J = juvenile rearing, S = spawning, E = EPA. Dark grayed cells with na indicate criteria not applicable. Light gray cells indicate sites where no bull trout were found but Idaho's criteria were still applied because the waterbody was within a Key Bull Trout Watershed.

No bull trout were documented in three streams (Bear Creek, Dear Creek, and Dry Creek), represented by four sites with 1997 temperature monitoring data. Idaho's bull trout juvenile rearing and spawning criteria were evaluated at these four sites were because they are on streams within the Little Lost Key Bull Trout Watershed identified in Governor Batt's Bull Trout Conservation Plan (State of Idaho 1996). Six other waterbodies had only 1 size/age class of bull trout documented. These six are Big Springs, Fallert Springs, Little Lost River at Buck n' Bird Road, Squaw Creek (tributary to Wet Creek), Summit Creek and Summerhouse Canyon Creek. All six are within the bounds of the Little Lost Key Bull Trout Watershed and both of Idaho's bull trout criteria were applied to all sites on these six streams as well.

Of 43 sites evaluated for 1997 temperatures, only two sites, in the upper portions of Badger Creek (WBID 8) and Williams Creek (WBID 9), did not have major exceedances of one or more applicable criteria. The lower bound of the upper portion of each creek is defined as the point at which they emerge from their mountain valleys, at or near the BLM/FS boundary. Seven sites violate only the EPA bull trout criteria, including Smithie Creek which has some of highest bull trout densities observed or reported (Bart Gammet, personal communication). A more detailed summary of 1997 temperature data can be found in appendix D, 1997 Salmonid and Bull Trout Temperature Criteria Exceedances.

Summary of existing beneficial uses and 1997 WBAG Assessments

The following (Table 19.) summarizes the water body assessments for the 1993-96 DEQ BURP sampling sites (Figure 19.). Each site is listed with its associated existing and/or designated beneficial uses. Support statuses were determined using the DEQ Water Body Assessment Guidance and addendums (DEQ 1996). There are two status calls, water body and site, for each segment listed. In cases where there was more than one site and site status assessments differed, the lowest site support status was assigned to the entire water body. In general, a waterbody in this table corresponds to stream in the Geographic Names Information System (USGS 1995).

Table 19. Existing beneficial uses and support statuses for 1993-96 data.

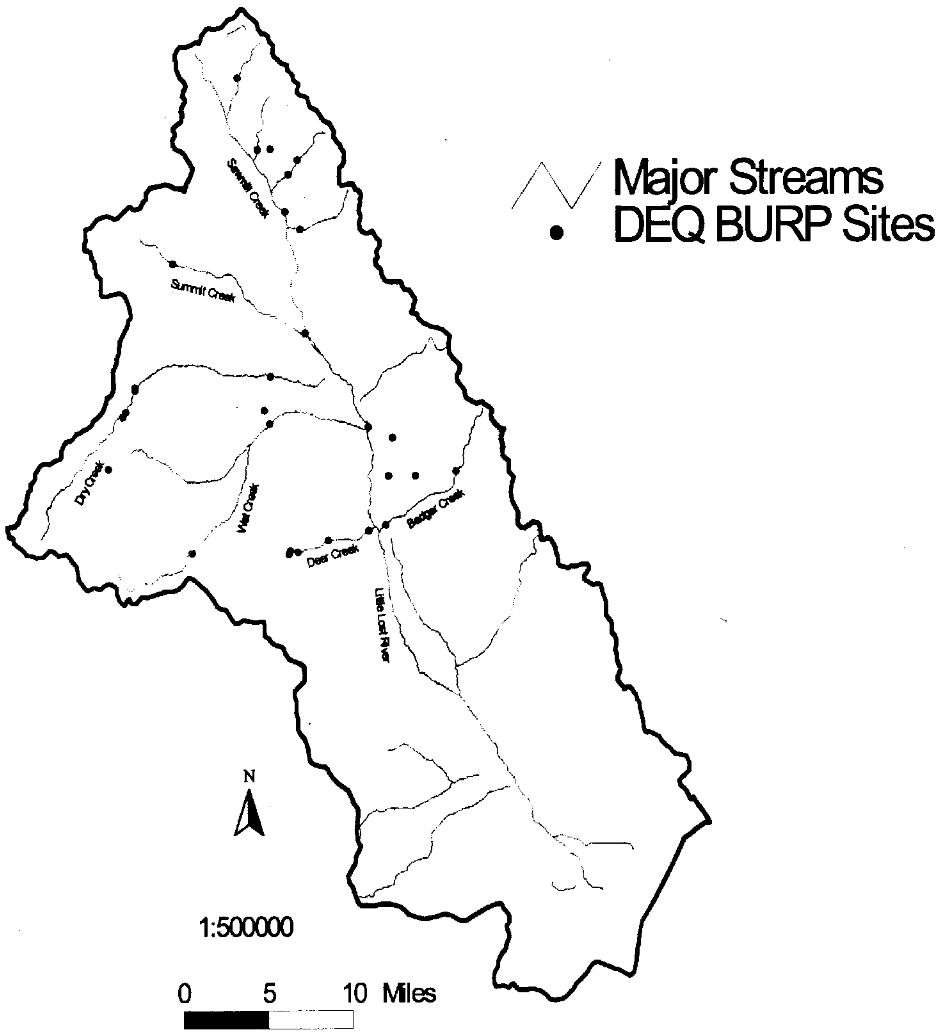
Water Body Status	Site Status	Water Body	BURP Site ID	WBID	CW		SS		PCR		SCR		AWS		1996 303(d)
FS	FS	Badger Creek	95EIRO0A07	8	E	FS	E	FS	D	FS			E	FS	*
FS	FS	Badger Creek	95EIRO0A08	8	E	FS	E	FS	D	FS			E	FS	*
FS	FS	Bear Creek	96EIROY167	16	E	FS	E	FS			D	FS	E	FS	
FS	FS	Deer Creek	95EIRO0A09	25	E	FS	E	FS			E	FS	E	FS	*
FS	FS	Deer Creek	95EIRO0A10	25	E	FS	E	FS			E	FS	E	FS	*
FS	FS	Deer Creek, South Fork	96EIROY156	25	E	FS	E	FS			D	FS	E	FS	
FS	FS	Deer Creek, North Fork	96EIROY157	25	E	FS	E	FS			D	FS	E	FS	
FS	FS	Deer Creek	96EIROY158	25	E	FS	E	FS			D	FS	E	FS	
NV	NFS	Dry Creek (diversion to Wet Creek)	94EIRO0028	20		NFS									*
NV	FS	Dry Creek (diversion to Wet Creek)	94EIRO0029	20	E	FS			D	NA			E	NA	*
NV	NV	Dry Creek (diversion to Wet Creek)	95EIRO0A13	20	E	NV			D	NA			E	NA	*
NV	FS	Dry Creek (diversion to Wet Creek)	95EIRO0A14	20	E	FS			D	NA			E	NA	*
FS	FS	Dry Creek (headwaters to diversion)	95EIRO0A15	21	E	FS	E	FS	D	FS			E	FS	*

Water Body Status	Site Status	Water Body	BURP Site ID	WBID	CW		SS		PCR		SCR		AWS		1996 303(d)
FS	FS	Dry Creek (headwaters to diversion)	95EIROA120	21	E	FS	E	FS	D	FS			E	FS	*
FS	FS	Garfield Creek	96EIROY163	14	E	FS					D	NA	E	NA	
FS	FS	Horse Creek	96EIROY160	9	E	FS	E	FS			D	FS	E	FS	
FS	FS	Horse Creek	96EIROY161	9	E	FS	E	FS			D	FS	E	FS	
NFS	NFS	Little Lost River (headwaters to sink)	94EIRO0033	10	D	FS	D	FS	D	NA	D	NA	D	NA	
FS	FS	Mill Creek	96EIROY166	14	E	FS	E	FS			D	FS	E	FS	
NFS	NFS	Sawmill Creek	95EIRO0B37	17	E	FS	E	NFS	D	NA			E	NA	*
NFS	NFS	Sawmill Creek	95EIRO0B38	12	E	FS	E	NFS	D	NA			E	NA	*
FS	FS	Squaw Creek	96EIROY164	23	E	FS	E	FS			D	FS	E	FS	
FS	FS	Squaw Creek	96EIROY165	15	E	FS	E	FS			D	FS	E	FS	
NFS	NFS	Summit Creek	94EIRO0034	19	E	FS	E	NFS	D	NA			E	NA	
FS	FS	Warm Creek	96EIROY162	13	E	FS	E	FS	D	FS			E	FS	
NFS	FS	Wet Creek	95EIRO0A11	24	E	FS	E	FS	D	NA			E	NA	*
NFS	FS	Wet Creek	95EIRO0A34	22	E	FS	E	FS	D	NA			E	NA	*
FS	FS	Williams Creek	96EIROY159	9	E	FS	E	FS			D	FS	E	FS	

(1) FS - Fully supported, NFS - Not fully supported, NV- Needs verification, D - Dry channel, unable to assess. Overall status for all designated or existing beneficial uses assessed.

(2) CWB - Cold Water Biota. SS - Salmonid Spawning. PCR-Primary Contact Recreation. SCR - Secondary Contact Recreation. AWS-Agricultural Water Supply. Although not listed, industrial water supply, wildlife habitats and aesthetics are designated for all waters of the state. Domestic water supply was not indicated as an existing or designated use and therefore, was not included in the table.

Figure 16. - DEQ BURP Sites



Little Lost River Subbasin - 4th Field HUC

2.2.3 Conclusions Regarding Water Quality Data Presented

1996 §303(d) Listed Streams

Table 20. is a summary of data used in this subbasin assessment to determine which of the 1996 §303(d) listed streams are currently water quality limited and which ones fully support their beneficial uses. Only three streams segments are confirmed to be water quality limited and will be carried forward into a loading analysis to complete a total maximum daily load (TMDL) analysis. Currently listed streams, or portions thereof, for which current data show full support of their uses[2] will not have a loading analysis performed under Idaho's eight-year TMDL development schedule.[3]

It will be noted that the number of entries in Table 21. does not correspond to the 1996 listing of six streams. This is due to refinement in boundaries which narrows the extent of impaired waters. In this table, waterbody extent was defined first by DEQ's Waterbody Identification (WBID) system, then by named tributaries within WBID for which beneficial use monitoring has occurred, and finally by eco-regional splits within a monitored stream.

For streams which are impaired, Table 21. also identifies the designated or existing beneficial use(s) affected. These uses will be the focus of the loading analyses and implementation plan for these streams. For these water bodies the following uses apply. Cold water biota (CWB) - water bodies that have been determined to support cold water biota based on the presence of cold water aquatic insects or fish such as trout. Geothermal waters, such as Barney Hot Springs, are exceptions to this designation. Salmonid spawning (SS) - water bodies which have been determined to sustain natural salmonid (salmon, trout, whitefish, ciscos, or char) reproduction.

Electrofishing data was used to determine whether salmonid spawning occurred in these streams or not. This was a necessary step prior to evaluating temperature criteria. Existence of spawning was defined as multiple age classes including young of the year. This use may or may not be currently designated in the Idaho water quality standards. The average age class structure for salmonids in the Little Lost River basin is at least one species exhibiting three age classes including young of the year per water body.

A major exceedance of the cold water biota criteria (22EC) was defined as a single daily maximum of at least 3EC over the criteria or at least 10 days of any exceedance during a year. A major

[2] If not de-listed as part of Idaho's biennial §303(d) cycle, these streams will be proposed for removal from the list concurrent with formal public review of this document.

[3] On April 7th, 1997 DEQ and EPA Region 10 submitted to the court an eight-year schedule to develop TMDLs for all waterbodies on Idaho's 1994 §303(d) list, on a subbasin by subbasin basis. The 1994 list received minor corrections in 1996 and is essentially the same list.

exceedance of the salmonid spawning criteria (13EC) was defined as a single daily maximum of at least 3EC over the criteria or at least 10 days of any exceedance during the spawning season of a particular species.

Given the vagaries of natural physical conditions of water, particularly for sediment and temperature, we have relied primarily upon biological measures as a more robust measure of stream health. The fact that biological populations develop in response to environmental conditions throughout their life cycle, not just those observed at the time of some human visit, is precisely why DEQ employs biological monitoring. However, when it comes to temperature, DEQ is obligated to use numeric criteria in the current water quality standards.

For several of the listed streams the biological signal is at odds with the numeric temperature criteria. It is not unreasonable or unexpected that biological signals sometimes contradict uniform criteria applied to all locations at all times. This is especially true in a state as geographically varied as Idaho. If sufficient sources of controllable human-caused thermal load can not be identified in these streams to explain and correct observed exceedances, then site-specific criteria will be required.

Both segments of Wet Creek are confirmed as water quality limited. Two of three segments of Sawmill Creek (WBID 12 and 14) are confirmed as water quality limited, primarily based on temperature exceedances. These four segments will have loading analyses performed to complete their TMDLs.

Dry Creek presents a special case. The boundaries specified on the 1996 §303(d) list (diversion to Wet Creek) refer to the actual diversion canal, a man-made waterway which should not have been listed in the first place. The channel of Dry Creek below the diversion (in T10N R25E NW¼ Section 31), where BURP data was obtained, is only occasionally wetted by flows too great to divert to Wet Creek. This is a long-standing diversion which pre-dates the effective date of the Clean Water Act[4]. In 1994 no water was present to conduct a macroinvertebrate collection. Water was present in the channel in 1995 and macroinvertebrates were sampled at two BURP sites. At both sites the macorinvertebrate samples obtained were meager. These samples may represent a remnant or ephemeral aquatic community adapted to intermittent flows, or merely drift from upstream. For the above reasons the presumption of cold water biota use is inappropriate to this portion of Dry Creek. Neither the diversion canal, nor the intermittent channel are proposed for loading analysis, however, because the diversion empties into Wet Creek, the Dry Creek watershed above the diversion will need to be considered as a source for pollutants to Wet Creek.

[4] Under the Clean Water Act states are required to protect designated uses and uses which existed on or before Nov. 28th, 1975, the date the federal implementing regulations were promulgated. Water quality problems which existed prior to this date are often termed legacy problems.

The remaining 1996 §303(d) streams are not found to be water quality limited, and will not be carried forward through a loading analysis. However, some of these streams are tributaries to water quality limited segments and will be considered as loading sources to those segments, even though they require no load analysis within their watershed. For example, the Main Fork of Sawmill (WBID 17) is not impaired but contributes flow to Sawmill Creek below Timber Creek (WBID 14) which is impaired for temperature. In the temperature loading analysis for Sawmill Creek downstream of Timber Creek, the relative contribution of the Main Fork above Timber Creek to downstream temperature exceedances will need to be examined.

Table 20. Summary of monitoring data for 1996 §303(d) listed streams.

Stream	**WBID (1)**	**Uses Affected (2)**	**MBI (3)**	**HI Ecoregion (4)/(5)**	**PFC (7)**	**SS Existing (8)**	**Major Temp. Exceedance (9)**
LOADING ANALYSIS / TMDL							
Badger Creek	8		4.86	110 SR	AR	Y	Y
Deer Creek	25		3.47- 4.26	81-101 SR	AR	Y	Y
Dry Creek (headwaters to diversion)	21		3.89	92 NR	nd	Y	Y
Dry Creek (headwaters to diversion)	21		4.22	73 SR	nd	Y	Y
Sawmill Creek (upper)	17		4.27	99 NR	nd	Y	Y
Sawmill Creek (middle)	14	SS			nd	Y	Y
Sawmill Creek (lower)	12	CWB, SS	4.55	78 SR	AR	Y	Y
Wet Creek (lower)	22	CWB, SS	4.09	77 SR	AR/ NF	N	Y
Wet Creek (upper)	24	CWB, SS	4.31	91 NR	AR	Y	Y
NO LOADING ANALYSIS							
Badger Creek	8		4.70	91 NR	nd	Y	N

Stream	WBID (1)	Uses Affected (2)	MBI (3)	HI Ecoregion (4)/(5)	PFC (7)	SS Existing (8)	Major Temp. Exceedance (9)
Dry Creek (diversion to Wet Creek)	20		3.01-4.42	51-88 SR	nd	nd	nd

(1) **WBID** - Idaho DEQ water body index number.
(2) **Uses Affected** - beneficial uses designated in the Idaho water quality standards or documented to exist since November 28, 1975 for which data available indicate impairment. These uses are to be protected or restored in the water body, in other words they direct goals for the TMDL.
(3) Macroinvertebrate biotic index (**MBI**) - Idaho DEQ multimetric tool used to evaluate the biological condition of a water body. Scores less than 2.5 are deemed to indicate impaired conditions. Scores are normalized (adjusted) based on ecoregional differences. A range of MBI scores is provided if the site was monitored more than once.
(4) Habitat Index (**HI**) - Idaho DEQ multimetric tool used to evaluate fish habitat conditions. A HI < 65 in the NR ecoregion, or < 59 in the SR ecoregion, indicate impairment of fish habitat. Habitat index scores are used with MBI to assess water body support status.
(5) **Ecoregion** - geographic areas with patterns of similar aquatic and terrestrial organisms and their environments, NR=Northern Rockies and SR=Snake River Basin/High Desert (Omernik and Gallant 1986). Because ecoregions define physical and biological expectations, water bodies with monitoring sites located in different ecoregions are listed separately.
(6) Proper Functioning Condition (**PFC**) - a U.S. Bureau of Land Management protocol to rate the physical condition of a stream corridor in three categories - riparian vegetation, soils/geology, and hydrology/streambank. The combined scores result in a rating of properly functioning (PF, score >80), functioning at-risk (AR, score 60-80), or non-functioning, unhealthy (NF, score <60). An entry of “nd” means no data available.
(7) Proper Functioning Condition (**PFC**) - a U.S. Bureau of Land Management protocol to rate the physical condition of a stream corridor in three categories - riparian vegetation, soils/geology, and hydrology/streambank. The combined scores result in a rating of properly functioning (PF, score >80), functioning at-risk (AR, score 60-80), or non-functioning, unhealthy (NF, score <60). An entry of “nd” means no data available.
(8) **SS Existing** - Streams where data used in this subbasin assessment indicates the existence of natural salmonid spawning. Entries of “Y” mean yes, data indicate successful spawning; “N” means fish were present but age structure does not indicate successful spawning; “no fish” means location was electorfished, but no fish were collected; and “nd” means no data.
(9) **Major Temperature Exceedance** - Streams where data used in subbasin assessment indicates daily maximum water temperatures clearly exceeded the applicable cold water biota and/or salmonid spawning instantaneous criteria.

Streams not on the 1996 §303(d) List

Table 21 summarizes the data for 33 monitored streams or portion of streams not listed on the 1996 §303(d) list. These waterbodies are divided into three categories: 1) Water Quality Management Plan (WQMP) Warranted; 2) Additional Information Needed; and 3) No WQMP Warranted, anti-degradation applies.

A WQMP is a non-regulatory water quality restoration plan. It describes a schedule of actions and follow-up monitoring designed to restore water quality in a stream not currently listed. The goals are the same as a TMDL, but the §303(d) requirements for content and review are not yet in play.

A loading analysis is not required, nor is EPA approval. These can possibly be avoided with a timely and successful WQMP.

Streams in category 1 identifies streams which are likely headed toward future §303(d) listing. For these streams available data showed impairment as indicated by low MBI score, major temperature exceedances, or lack of natural salmonid spawning in waters so designated. These might be streams already on the mend, or streams in decline, although these trends are unknown. Identifying these streams here offers an opportunity to be pro-active in prescribing corrective actions through a WQMP, or including them under the umbrella of TMDL implementation plans for adjacent listed streams. In the case of streams for which corrective actions are underway an opportunity exists to document that these streams are indeed improving prior to the next biennial §303(d) listing process.

Category 1 includes 23 waterbodies or waterbody segments. Big Creek, Little Lost River and Summit Creek are included due to major temperature exceedances of the cold water biota (22EC) or salmonid spawning (13EC) instantaneous criteria in 1994, 1995, or 1996. Fifteen additional waterbodies or portions of waterbodies are included due to major 1997 temperature exceedances of one or more salmonid spawning or bull trout temperature criteria. Fish data for Hawley Creek, Jackson Creek, and the Little Lost River but did not exhibit existence of natural salmonid spawning. Mahogany Creek showed a low MBI score (1.56), which may indicate impairment of cold water biota. Of the two samples collected on this creek (above and below the diversion), the site below the diversion had the low MBI score. Mahogany Creek was also electrofished, but no fish were collected.

It should be noted that fourteen of the category 1 streams are tributaries to already known water quality limited waters (see earlier discussion of 1996 §303(d) listed streams). These are Basin, Big, Coal, and Squaw Creeks, tributaries to Wet Creek, and Bear, Hawley, Iron, Jackson, Mahogany, Main Fork, Mill, Smithie, Squaw and Timber Creeks, tributaries to Sawmill Creek. This is therefore a finer resolution of the extent of impairment. Under a watershed approach these streams would likely be addressed as part of the effort to restore the impaired waters which they feed. If this is done then their identification here has little or no practical effect except to better focus source identification and control.

Streams in category 2 are those for which the available data are insufficient to conclude whether water quality problems exist or not. Further investigation of these streams is needed in the short term. This may mean further instream monitoring, or it could mean clarification of certain historical or natural physical factors which better explain the current monitoring results. Barney Creek, Bull Creek, Garfield Creek, and a portion of Summerhouse Canyon are in the "additional information needed" category.

Barney Creek received a 3.12 MBI score which signifies uncertainty about cold water biota support status. However, cold water biota may not be natural to this system since the water body is fed in part by a geothermal spring (Barney Springs). Although some salmonid fish were found in Barney Creek, the quantity of geothermal water entering Barney Creek may preclude a typical assemblage of cold water biota.

No fish were collected in Bull Creek, Garfield, or Summerhouse Canyon during electrofishing. Summerhouse Canyon is formed by a stream whose entire flows sinks into the alluvial fan at its mouth. This natural barrier may explain this lack of fish. It is not known whether other natural barriers to fish movement exist on Bull or Garfield Creeks. Without further information, it is difficult to determine if the lack of fish is due to natural factors or man-caused factors. If man-caused factors are determined to be the reason these streams are barren then remedial action would be in order. Only if this factor is identified as a pollutant would these streams become candidates for §303(d) listing.

Category 3, "no WQMP warranted," contains non-303(d) listed streams for which available monitoring data indicate they are healthy and meeting water quality standards. The streams included in this grouping had existence of natural salmonid spawning (except Moffet Creek for which no fish data was available), no major temperature exceedances (where data available), and good MBI and HI scores. These streams, as well as streams removed from the §303(d) list, are subject to the anti-degradation provisions of law and will be monitored according to the DEQ BURP 5-year cycle to verify continued support of their beneficial uses.

Table 21. Summary of monitored streams not on the 1996 §303(d) list.

Stream	**WBID (1)**	**Uses Affected (2)**	**MBI (3)**	**HI Ecoregion (4)/(5)**	**PFC (6)**	**SS Existing (7)**	**Major Temp. Exceedance (8)**
WQMP WARRANTED							
Basin Creek	24	SS	nd	nd	nd	Y	**97**
Big Creek	24	SS	4.10	100 SR	AR	Y	**Y**
Big Springs Creek	3	SS	nd	nd	nd	Y	**97**
Bear Creek	16	SS	4.82	78 SR	nd	Y	**97**
Fallert Springs Creek	3	SS	nd	nd	nd	Y	**97**
Coal Creek	24	SS	4.81	98 SR	nd	Y	**97**
Hawley Creek	14	SS	5.05	95 NR	nd	**N**	nd
Iron Creek	14	SS	5.07 - 5.24	104 - 105 NR	nd	Y	**97**

Stream	WBID (1)	Uses Affected (2)	MBI (3)	HI Ecoregion (4)/(5)	PFC (6)	SS Existing (7)	Major Temp. Exceedance (8)
Jackson Creek	14	SS	5.04	106 NR	nd	**N**	nd
Little Lost River	2	SS	nd	nd	AR	**N**	**Y**
Little Lost River	7	SS	nd	nd	NF	**N**	**97**
Little Lost River	9	SS	nd	nd	NF	Y	**Y**
Little Lost River	10	SS	4.46	62 SR	NF	Y	**Y**
Mahogany Creek	12	CWB	**1.56** - 5.7	81 - 108 SR	nd	no fish	nd
Main Fork Creek	17	SS	4.58	92 NR	nd	Y	**97**
Mill Creek	14	SS	5.70	85 SR	nd	Y	**97**
Summit Creek	19	CWB SS	4.04	86 SR	AR	Y	**Y**
Summerhouse Canyon Creek	19	SS?	4.97	85 SR	nd	no fish	**Y**
Smithie Creek	17	SS	5.08	80 NR	nd	Y	**97**
Squaw Creek (near Wet Creek confluence)	23	SS	3.75	92 SR	NF	Y	**97**
Squaw Creek (Sawmill Canyon)	15	SS	5.23-5.28	95-104 SR	nd	Y	**97**
Timber Creek	18	SS	4.85 - 5.02	95 - 103 NR	nd	Y	**97**
Williams Creek	9	SS	4.22	80 SR	AR	Y	**97**
ADDITIONAL INFORMATION NEEDED							
Barney Creek	19		**3.12**	85 SR	nd	N	nd
Bull Creek	14		4.99	75 NR	nd	**no fish**	nd
Garfield Creek	14		3.74	74 SR	nd	**no fish**	nd

Stream	WBID (1)	Uses Affected (2)	MBI (3)	HI Ecoregion (4)/(5)	PFC (6)	SS Existing (7)	Major Temp. Exceedance (8)
Summerhouse Canyon Creek	19		4.03	113 NR	nd	**no fish**	nd
NO WQMP WARRANTED							
Deer Creek, North Fork	25		3.61	84 SR	nd	Y	nd
Deer Creek, South Fork	25		3.76	81 SR	nd	Y	nd
Horse Creek	9		4.02-4.72	84-85 SR	nd	Y	nd
Little Lost River	1		nd	nd	nd	Y	nd
Meadow Creek	12		4.74	89 SR	nd	Y	nd
Moffett Creek	19		3.81	88 SR	nd	nd	nd
Red Rock Creek	18		4.72	102 NR	nd	Y	nd
Warm Creek	13		5.41	93 SR	nd	Y	nd

An entry of "nd" means no data available.

(1) **WBID** - Idaho DEQ water body index number.

(2) **Uses Affected** - beneficial uses designated in the Idaho water quality standards or documented to exist since November 28, 1975 and for which data available indicate impairment. CWB = Cold water biota. SS = Salmonid spawning. These uses are to be protected or restored in the water body, in other words they direct goals for restoration efforts.

(3) **MBI -** Macroinvertebrate Biotic Index. Idaho DEQ multi-metric tool used to evaluate the biological condition of a water body. Scores less than 2.5 are deemed to indicate impaired conditions. Scores are normalized (adjusted) based on ecoregional differences. A range of MBI scores is provided if the site was monitored more than once.

(4) **HI** - Habitat Index. Idaho DEQ multimetric tool used to evaluate fish habitat conditions. A HI < 65 in the NR ecoregion, or < 59 in the SR ecoregion, indicate impairment of fish habitat. Habitat index scores are used with MBI to assess water body support status.

(5) **Ecoregion** - geographic areas with patterns of similar aquatic and terrestrial organisms and their environments, NR=Northern Rockies and SR=Snake River Basin/High Desert (Omernik and Gallant 1986). Because ecoregions define physical and biological expectations, water bodies with monitoring sites located in different ecoregions are listed separately.

(6) Proper Functioning Condition (**PFC**) - a U.S. Bureau of Land Management protocol to rate the physical condition of a stream corridor in three categories - riparian vegetation, soils/geology, and hydrology/streambank. The combined scores result in a rating of properly functioning (PF, score >80), functioning at-risk (AR, score 60-80), or non-functioning, unhealthy (NF, score <60).

(7) **SS Existing** - Streams where data used in this subbasin assessment indicates the existence of natural salmonid spawning. Entries of "Y" mean yes, data indicate successful spawning; "N" means fish were present but age structure does not indicate successful spawning; "no fish" means location was electrofished, but no fish were collected.

(8) **Major Temperature Exceedance** - Streams where data used in subbasin assessment indicates water temperatures clearly exceeded any of the applicable cold water biota, salmonid spawning, or bull trout temperature criteria.

2.3. Data Gaps in Assessing Water Quality Data in Little Lost River

Further investigation is needed concerning the subbasin's natural temperature regime, stream channel shading, and the occurrence of salmonid spawning. Stream data showed many cases where water quality criteria for temperature was exceeded and yet evidence of salmonid spawning was apparent. Refinement of actual spawning periods and locations could reduce the apparent incidence of temperature exceedances. Even if so, it seems that the current salmonid spawning and bull trout temperature criteria maybe inappropriate for all stream locations in this subbasin. Monitoring of source spring temperatures of spring fed streams, such as Deer Creek, Big Springs Creek, and Fallert Springs Creek, will be needed to ascertain the attainability of salmonid spawning temperatures in these streams.

More in depth analysis of surface fines data, and possible additional sampling of surface fines in reference reaches, will be needed to confidently establish a suitable sediment target for streams in this subbasin. Further data on streambank condition would be useful. It is known that the Forest Service has completed R1/R4 fish habitat inventories for many of the Little Lost tributaries under their jurisdiction. These surveys, conducted according to the procedures of Overton and others (1997) would provide extensive information on existing stream channel characteristics. At the time of this report, these data are in the process of being entered into a database and were not available. Examination of aerial photos could also provide information on the extent of eroding streambanks, mass wasting, and stream channel shading.

Three streams that were electrofished without obtaining any fish need to be checked for natural or artificial barriers to fish passage that could explain their barrenness. Several segments, including the middle segment of Sawmill Creek (WBID 14, Warm Creek to Timber Creek) and three segments of the Little Lost River (WBID 9, 7, 2) have not been BURPed though 1997. Beneficial use reconnaisance information on these segments could clarify their status.

Although we were provided water rights data from IDWR, we were unable to quantify the amount of water diverted from specific streams. This is largely because of overlapping water rights and dormant water rights that were approximately 2 times the flow of the Little Lost River. Since the Little Lost River flows year around, we knew that not all the water rights were being exercised, and could not determine the extent to which actual consumptive water use occurred.

Finally, to date BURP sites have been predominately located in the upper portion of the subbasin above Badger Creek. This distribution is partly due to the occurrence of dry streams at the time of BURP monitoring. There were some 1997 BURP sites located further south, however, additional sites would provide important biological information and complement BLM monitoring results.

3. POLLUTANT SOURCE INVENTORY

3.1. Pollutant Sources in Little Lost River Watersheds

There are no known point sources in the Little Lost River subbasin. Potential nonpoint sources consist of land disturbance from grazing, timber harvest, and unmaintained roads. The following provides an overview of nonpoint sources by watershed for streams currently listed as water quality limited (1996 §303(d) list).

Sawmill Creek watershed

Sawmill Creek is listed for sediment and temperature. Current boundaries for the water quality limited segment are from the confluence with Summit Creek to its headwaters. This source inventory will consider the entire watershed which feeds lower, impaired reaches.

In November 1997 the Lost River Ranger District of the Challis National Forest completed a watershed analysis on the Sawmill Creek watershed above the old USGS gaging station just below the Warm Creek confluence, basically restricting the analysis to Forest Service managed lands.

An important influence on the condition of the Sawmill Creek watershed were two large wildfires. Both of these were intense, stand replacing fires, both were human caused. The Warm Creek fire burned 6,393 acres of range and forest land in the lower watershed in 1966. In 1988, the Little Lost fire burned 6,246 acres in the Smithie Fork drainage in the upper, more forested portion of the watershed. These fires aggravated high runoff and coupled with poor riparian conditions along lower Sawmill Creek, lead to what has been described as ‘blowout’ conditions below the Forest Service boundary and mouth of Sawmill Canyon.

The Idaho Falls office of the BLM has been intensively monitoring the lower portion of Sawmill Creek since 1986 in association with a riparian restoration project. As this effort began the lower portion of Sawmill Creek running through BLM lands was in poor shape. Riparian areas had been over-grazed de-stabilizing the stream channel. When high flows came the stream went through severe lateral bank erosion and aggradation, widening to a 200' across braided channel in places. Historically portions of this reach were routinely and repeatedly channelized in attempt to slow loss of water through the streambed and concentrate flow to aid diversion. At one time the stream was entirely diverted to Summit Creek to avoid the loss of water through Sawmill’s lower channel. These practices have ceased, management of livestock modified, and riparian vegetation has greatly recovered. (Dan Kotansky, personal communication)

The Forest Service reports 99.2 miles of road in the 57,924 acres covered by the watershed analysis, or about 1.01 miles per square mile. Overall this is a relatively low road density, but roads are more concentrated in areas where timber harvest has occurred and are of particular concern in the western portion of the watershed. In this area slopes are steeper, requiring greater cuts and fills, while soils derived from the Challis Volcanics are more erodible and susceptible to mass failure. Of the 99.2 miles of road, 5 miles are considered to be 4WD and 8.5 miles are light duty, the remaining 85.7 miles are unimproved roads.

Between 1960 and 1980 8,821 acres were harvested for timber with silvicultural treatment ranging from over-story removal to clear-cut. Since 1980 the only timber harvest occurred in 1990, totaling 1,116 acres, predominantly salvage in the wake of the Little Lost fire. Currently three timber sales are being planned. The proportion of forest trees less than thirty years old has increased from 8 percent to 16 percent due to fires in the watershed. In addition 7 percent of the coniferous forest habitat is in equivalent clear cut acres. Thus a combined 23 percent of the forest area is in stage of growth which increases water yield relative to a mature forest, most of this area has had at least ten years to recover since last disturbed. One cattle allotment exists in Mill Creek area with 550 cow/calf pairs grazing from July through September. Aquatic habitat inventories conducted since 1994 indicate that overall condition in the Sawmill Creek drainage is good to excellent.

In addition to these larger influences, several more specific problem areas have been identified by the Forest Service. Although 30 years has passed since the Redrock Creek timber harvests, some skid trails have not re-vegetated and still show evidence of rill erosion. An increase in bed fines was visually apparent below drive-through crossings and at the mouth of Redrock Creek. Recently these crossings have been blocked and culverts removed in this drainage. In the past a section of Timber Creek, below Redrock Creek, was harvested to the bank. This reach now shows channel braiding, with a high width to depth ratio, and active bank erosion. Other sections have down cut and become entrenched and low gradient sections have excessive depth fines (greater than the 30% forest standard).

In general, surveys of bank stability have showed very few unstable banks (summary statement in Watershed Analysis report based on R1/R4 fish habitat survey data as yet unavailable to DEQ), with streams on eastern quartzite side of the watershed showing little evidence of bank erosion. On the volcanic western side of the watershed the lower section of Iron Creek has only 63 percent bank stability. An old bridge on Iron Creek that was only partially removed directs flow into the bank causing active erosion. Recent slope failures have been observed in association with harvest access roads in the area from Jackson Creek to Slide Creek, but it is not known how much the incidence of mass wasting may have increased.

Wet meadows at the head of Smithie Fork and Firebox Meadows have been severely trampled by livestock and elk. Soil compaction and hummocking leading to increased runoff in meadows and head cutting is not uncommon in high elevation meadows that are being grazed. These changes are detrimental to the continued vitality of the meadows as well as a source of sediment to downstream channels. Due to deteriorated conditions Firebox Meadow has been closed to livestock grazing. Measurements of percent fines in spawning gravels of Mill Creek in 1996 and 1997 showed an increase from 20.9 to 30.9.

Proper functioning condition (PFC) assessments indicate Redrock Creek, Timber Creek below Redrock confluence, Iron Creek, and Mill Creek exhibit excessive bank erosion and abundant fine sediment in their beds. These are potential source areas to downstream reaches of Sawmill Creek.

Bull trout have been found in most perennial streams in the watershed, including Sawmill Creek (a.k.a. upper Little Lost) itself. It is estimated that bull trout occur in 38.6 miles of stream. Stream temperature measurements at the Forest boundary in 1994, a hot, dry year, indicate Sawmill Creek exceeded 15°C for 82 days and went over 20°C 17 days. In 1995, a much cooler and wetter year, stream temperatures at the same location exceeded 15°C on 38 days and never exceeded 20°C. Rieman and McIntyre (1993) report 15°C as a temperature limit for the distribution of bull trout. It is not known whether such temperature can be attained at all times throughout Sawmill Creek, particularly below Warm Creek on BLM ground.

Over the past decade conditions in the lower watershed have been steadily improving in lower Sawmill Creek as a result of restoration efforts overseen by the BLM. This restoration was financed as mitigation for the 1984 construction of a winter flood control diversion on the Little Lost River 7 miles NW of Howe. Though riparian trees have largely returned to most of this reach the channel is still adjusting and stream temperatures still exceed criteria at times. Recovery is slowed by the coarse materials left in the wake of the “blowout”. This reach of stream was inventoried for BLM in 1993 and 1994 using PFC protocol to assess its physical condition.

Riparian vegetation, soils/geology, and hydrology/streambanks are the three major component categories of BLM PFC. Each category is in turn based on rating of several items. Proper Functioning Condition reports of inventories were examined for areas in which one of the three component categories of the inventory were rated as non-functioning as a means to more specifically identify areas of greater potential sediment loading. The individual component items within non-functioning categories having a score of one-third or less of the maximum were tallied to provide greater insight into potential sources. This tally is presented in Table 22.

Table 22. Potential Source Areas in Sawmill Creek based on PFC Breakdown.

Record ID	Location	T	R	Sec	¼¼	NF Category	Score	Line items[1]
9300021	Hawley Mtn Allotment	11N	26E	3	SESE	soils/geo	50	9
9300026	“	“	“	23	NENE	soils/geo	50	9
9300028	“	“	“	26	SWSW	hydro/bank	53	15
9400030	“	“	“	35	SWSE	hydro/bank	47	13,14, 15
9400031	“	“	“	“	NWSE	hydro/bank	47	13,15

Record ID	Location	T	R	Sec	¼¼	NF Category	Score	Line items[1]
9400032	“	10N	“	2	SWSE	hydro/bank	47	12,13, 15
9400033	“	“	“	“	NESW	hydro/bank	40	13,14, 15

[1] 9= lack of fine material for plant growth, 12= streambank vegetation highly alter by human-caused disturbance, 13= lack of roots binding streambank, 14= stream channel incised, 15= unstable channel

Wet Creek Watershed

Wet Creek is listed for sediment, temperature, and flow alteration. Boundaries of this listing are from mouth, at the Little Lost River, to headwaters, at Pass Creek Summit. The Wet Creek Watershed can be divided into three sections for purpose of discussion. The upper watershed including tributaries Big and Basin Creeks, the middle watershed between Basin Creek and the Pass Creek road crossing below Squaw Creek confluence, and the lower watershed from Pass Creek road to the mouth. The upper watershed is largely managed by the Forest Service, while the lower two portions are largely managed by BLM.

The primary land use and man-caused influence on water quality in Wet Creek is grazing. In the upper watershed the intensively managed Pass Creek allotment runs 7314 animal unit months (AUM) on 43,632 acres, of which about roughly 24,000 acres are in the Wet Creek watershed. On BLM ground, three allotments involving the Wet Creek watershed are active. Immediately adjacent to Forest Service land the Squaw Creek allotment current use (1998) is at 1691 animal unit months AUMs seasonal from May 18th through June 30th. In the middle watershed the sprawling Hawley Mountain allotment runs 5612 AUMs on a rest rotation cycle over 71,655 acres from May 1st until the end of the year. Lower down the Wet Creek allotment allows for 602 AUMs on 6806 acres on a deferred rotation from mid-May to mid-July and again from mid-October to the end of the year.

Table 23. compares the intensity of use of these allotments expressed as acres per AUM. These numbers do not take into account range capacity which is undoubtedly greater in the wetter upper portion of the watershed, nor do they account for intensive management such as riparian fencing, off stream watering, and driving of herds which can reduce the affects of grazing on streams. These compare to a range throughout the subbasin from 49 acres per AUM on the Meadow Creek and Uncle Ike allotments to 5 acres per AUM on the Mill Creek allotment.

Table 23. Grazing Intensity on Allotments in Wet Creek Watershed.

Allotment	Acres	AUMs	Acres/AUM
Pass Creek	43,632	7314	8.2
Squaw Creek	17,949	1691	10.6
Hawley Mtn.	71,655	5612	12.8
Wet Creek	6,806	602	11.3

There are 138 miles of road in the watershed, less than one mile per square mile. These roads make at least 24 stream crossings and the majority of these roads are on lower ground managed by BLM. Pass Creek road runs the length of the watershed and is a major travel route between the Big Lost valley and Little Lost valley. This road makes at least five stream crossings and closely parallels Wet Creek for about 1.5 miles just above the Forest boundary. The 1994 Forest Travel Plan has closed three miles of road in the Wet Creek headwaters to travel in order to reduce soil erosion.

Riparian vegetation, soils/geology, and hydrology/streambanks are the three major component categories of BLM PFC. Each category is in turn based on rating of several items. Proper Functioning Condition reports from inventories conducted in 1993 and 1994 were examined for areas in which one of the three component categories of the inventory were rated as non-functioning as a means to more specifically identify areas of greater potential sediment loading. The individual component items within non-functioning categories with a score of one-third or less of their possible maximum were tallied to provide even greater insight into potential sources. This tally is presented in Table 24.

Table 24. Potential Source Areas in Wet Creek based on PFC Breakdown.

Record ID	Location	T	R	Sec	¼¼	NF Category	Score	Line items[1]
9300038	Squaw Creek	9N	26E	30	SESW	hydro/bank	53	12,15
9300005	Hawley Mtn	"	"	30	NENE	hydro/bank	53	12,13
9300006	"	"	"	20	swsw	hydro/bank	53	12,15
9400033	"	"	"	17	SWSE	veg	57	3,8
9400049	"	"	"	"	NWSE	hydro/bank	58	12,14
9400052	"	"	"	8	SWSE	hydro/bank	27	12,13,15

Record ID	Location	T	R	Sec	¼¼	NF Category	Score	Line items[1]
9400054	"	"	"	"	NESW	soils/geo	50	10
9400044	"	10N	26E	33	SESE	veg	57	2,3,6,8
9400045	"	"	"	34	NWSE	soils/geo	33	9,10
9400046	"	"	"	"	NESE	soils/geo	17	9,10
9400047	"	"	"	35	NENW	soils/geo	17	9,10
9400048	Wet Creek	"	"	36	NWS	soils/geo	33	9,10
9400051	"	"	"	"	SENW	soils/geo	0	9,10
9300002	"	"	27E	31	SESW	hydro/bank	53	12

[1] 2= woody vegetation dying out, 3= over utilization of woody vegetation, 6= canopy cover lacking, 8= undesirable herbaceous plants abundant, 9= lack of soil for plant growth, 10= bare soil due to human-caused disturbance, 12= streambank vegetation highly altered by human-caused disturbance, 13= lack of roots binding streambank, 14= stream channel incised, 15= unstable stream channel

Gamett (1998) reports observing severe streamside degradation due to riparian area grazing in lower Basin Creek, a tributary to wet Creek. This author also reports recreational and grazing damage to streambanks in the Big Creek tributary to Wet Creek, some of which has been addressed through road closures.

A major influence on channel conditions in lower Wet Creek is the Dry Creek hydropower plant which diverts nearly all of the non-flood flow of Dry Creek into the lower Wet Creek channel at a point about 2 miles below Squaw Creek. Addition of this water about doubles the flow in Wet Creek during the summer months and has severe channel erosion as the stream re-adjusts to a new flow regime. This also created a fish passage barrier which was mitigated in 1992 with a fish ladder. Incisement of the channel has resulted in abandonment of the former floodplain and left the adjacent riparian area high and dry for several miles. Consequently restoration of this reach would be difficult and recovery quite slow.

Dry Creek

Dry Creek is composed of two listed segments with the break occurring at the point of the hydropower diversion in T10N R25E section 31. The upper segment was listed for sediment and temperature and will be further discussed below. The lower segment is listed for sediment and temperature as well. This lower section is largely within BLM's Hawley Mtn grazing allotment and is publicly owned except for a couple of sections north of Taylor Mountain. Flows here have been greatly reduced in summer months by the water right for the Dry Creek hydropower development and a greater portion of this creek is now dry, a situation which apparently goes back quite some time. The USGS topographic 7 ½ foot map for the area shows the diversion and indicates the channel below it is intermittent. This map is dated 1967. Little else is known about the condition of this stream.

Badger and Deer Creeks

In 1994 EPA listed Badger Creek for nutrients, sediment and temperature and Deer Creek for sediment temperature, and flow alteration. Biological data indicates these streams and the upper segment of Dry Creek are now meeting their beneficial uses. Fisheries data collected by the Forest Service and BLM support these assessments. However, because of 1997 temperature exceedances, all but the portion of Badger Creek above the Challis National Forest boundary will remain 303(d) listed.

3.2 Data Gaps in Source Identification in Little Lost River

Very little is known at this writing of the conditions in the Dry Creek drainage for listed sediment and temperature. The Forest Service is planning to do a Watershed Analysis for the upper portion of Wet Creek later this year. This analysis might include upper Dry Creek as well. Information would still be needed for the Dry Creek drainage located on BLM land. It would be useful for the Forest Service and BLM to collaborate their efforts and prepare an entire Wet/Dry Creek watershed analysis.

Validation and further detail of suspected sediment source areas would be most useful. On-site inspection could identify more precise locations of sediment sources such as failing stream banks and eroding road surfaces, and areas of diminished stream side cover to moderate temperature. Recent aerial photos could be used to assess the extent of streamside cover, but would need to be followed up by ground-truthing to establish probable causes of reduced stream shading, natural or not. More detailed source identification will be critical to development of a loading analysis and implementation plan for water quality limited streams.

Little is known about current mass wasting potential in the subwatersheds with identified sediment problems. Additional expertise and information, such as aerial photo interpretation, would be helpful in identifying areas sensitive to mass failure as well as the incidence of failures. On the ground knowledge will likely be needed to establish human factors which may be involved.

Forest Service R1/R4 fish habitat survey data could be useful in identifying source, transport and response reaches and identifying problem in Upper Wet Creek areas much like the PFC data was used on BLM lands.

Bart Gamett (personal communication 5/5/98) reports that water temperature of the springs feeding the north and south forks of Deer Creek were measured at 13º C in 1997. He also reports Barney Hot Springs temperature measuring 28º C on June 20, 1996 and again on May 31, 1997. Little is known of the temperatures of other springs which are the source of many streams in the Little Lost River. The source water temperature of all spring fed streams should be determined prior to a loading analysis for temperature on streams such as Deer Creek. If the water emerges from the ground at 13º C the current Idaho salmonid spawning criteria are not attainable.

4. SUMMARY OF PAST AND PRESENT POLLUTION CONTROL EFFORTS

The following is a discussion of the past and present pollution control efforts in portions of the Little Lost River subbasin. The summary draws heavily from personal communications with the Forest Service and BLM. In fact, much of the section uses write-ups provided by the BLM and the Forest Service Sawmill Creek Watershed Analysis. The following discussion focuses on water bodies with previously identified problems and does not attempt to cover all of the pollution control efforts conducted in the subbasin.

Sawmill Creek Watershed

Upper Sawmill Creek

The Forest Service has shortened the length of the grazing season and closed some areas, such as Firebox meadows, to grazing. The Forest Service's Mill Creek Allotment Management Plan reduced utilization standards from 60% for grass/grass-like species and 30% for woody species in 1977 to 50% and 20% in 1996, respectively. Within the Horse Lake Unit, the plan decreased utilization to 35% for grass/grass-like species and 20% for woody species. Using additional fencing, the Management Units were increased from three units to six which reduced the duration of livestock grazing in any one unit. The maximum grazing duration is limited to 20 days and the new allotment management plan requires a rider to be on the allotment at least 5 days per week to improve livestock distribution. Management by the Forest Service has reduced the number of livestock grazing in the analysis area from 9550 sheep and 1964 cattle and horses in 1928 to the current 550 cow/calf pairs (USFS 1997, Mike Foster, personal communication).

Forest Service plans to limit the amount of equivalent clear cut acres to below 20 percent of the watershed. The Forest Service also plans to remove the bridge decking and abutment in Iron Creek to reduce sediment entering the stream (Mike Foster, personal communication, USFS 1997).

The 1994 travel plan restricted travel on National Forest lands through closing 11 miles of road throughout the Sawmill Canyon area (Foster 1998a). The Forest Service does not plan to add or decommission any roads, however, the agency plans to improve road maintenance if funding is available (Mike Foster, Personal Communication 1998b).

Lower Sawmill Creek

The Sawmill Creek Riparian Project began in 1987 as mitigation for the loss of riparian and fish habitat from the construction of the Howe Sink Trenches. The Sawmill Creek Project consists of 8 miles of fencing to control livestock grazing with the upper 4.5 miles grazed spring-only and the lower 3.5 miles excluded except for some light grazing. Also, a 2-mile pipeline from Y-springs to 3 troughs was installed to improve livestock distribution. Spring only grazing in the Upper Pasture usually means around 200 to 300 cows using the pasture for two to three weeks in the month of

May. This pasture was traditionally grazed for two years then rested the third year (Kotansky and others, 1996). According to the BLM, lateral cutting has been reduced to 30% and channel structure, complexity and natural sinuosity are returning to the system after 10 years of intensive riparian management (BLM, Dan Kotansky and Pat Koelsch personal communication 1998).

Wet Creek Watershed

Wet Creek

BLM initiated stricter grazing management in 1980 and 1996. Wet Creek, from the Forest boundary to the confluence of Squaw Creek, falls within the BLM Squaw Creek and Hawley Mountain Allotments. Wet Creek has 2.4 miles in the Squaw Creek Allotment and is managed as a 3 pasture, rest rotation system. The reach is an early season riparian pasture where livestock are held for 1-2 weeks before moving across Wet Creek to two large pastures. All of the stream reach within the Hawley Mountain Allotment is managed as a 10 pasture, modified rest rotation system. All of the stream reach within the Hawley Mountain Allotment is managed as two riparian pastures. The upper 1.2 miles (i.e., the old Hartman property) is being rested to restore riparian condition and will ultimately be managed as a spring grazing only pasture. The 2 miles receives spring grazing only with some fall trailing. According to BLM, the 2.4 miles reach below the forest boundary (Squaw Creek Allotment) appears to be nearing equilibrium and moving toward proper functioning condition. The lower 3.2 mile reach, although vastly improved over the last 10 years, apparently is still recovering from years of heavy grazing. Riparian, channel and bank conditions are still only rated as fair to poor overall (BLM personal communication 1998).

Wet Creek below the Squaw Creek confluence to the Dry Creek Hydro outfall is within the Hawley Mountain Allotment. The upper reach from Squaw Creek to the Pass Creek road bridge receives no grazing at present while the lower reach from the bridge downstream to the Dry Creek Hydro receives spring grazing only. BLM states that the lower 2.5 miles of this reach has characteristics similar to the downstream “blowout” reaches as it historically carried discharges from the Dry Creek irrigation canal prior to the development of the Dry Creek Hydropower project. However, with the removal of the Dry Creek water and the establishment of a riparian pasture, BLM thinks this reach is undergoing significant recovery. BLM noted that habitat conditions above the Pass Creek Road Bridge are good to excellent and still improving. However, the trout populations have not responded to this vast improvement and BLM mentions excessive sediment as the likely culprit (BLM personal communication 1998).

The Wet Creek reach below the Pancheri diversion to the confluence of the Little Lost River is about 3 miles. The reach falls within the Wet Creek Allotment which is managed as a 2 pasture, deferred rotation system. According to BLM, the area is inherently unstable due to extremely high flows produced by the combination of natural Wet Creek flows and discharges from the Dry Creek Hydropower project. However, the stream appears to be trying to stabilize itself and create a new floodplain within the deeply incised channel. In general, the existing fishery habitat condition is fair with a stable or slow upward trend. Prior to 1992, the Pancheri diversion was a nearly complete fish migration barrier. In 1992, a fish ladder was constructed on the diversion re-opening 90% of the Wet Creek drainage for trout spawning migrations of the Little Lost River drainage (BLM personal communication 1998).

The Forest Service has implemented pollution control practices through managing grazing practices and restricting road use. In 1994, the Forest Service developed 2 new pastures by dividing 2 existing pastures into 4. These pastures are located in the USFS Pass Creek Allotment management area (USFS 1997). The 1994 Challis National Forest travel map indicates 3 miles of restricted road use in the Wet Creek subwatershed.

Dry Creek

Dry Creek is included in the USFS 1987 Dry Creek Sheep and Goat Allotment Plan. The plan calls for an extensive modified rest-rotation management system among five units. The 1994 Challis National Forest travel map did not indicate any restricted road use in this area.

Big Creek

Big Creek flows 1.3 miles from the forest boundary downstream to the Wet Creek confluence in the BLM Squaw Creek Allotment. As mentioned previously, the Squaw Creek Allotment is managed as a 4 pasture, rest rotation system. The riparian zone is not excluded or protected from grazing. BLM mentions livestock over-utilization and firewood collection having major impacts on the health of the riparian zone. BLM suggests changing use to early season and developing a recreational plan (BLM personal communication 1998).

Williams Creek Watershed

Badger Creek

Badger Creek is located in the BLM Horse Creek and Uncle Ike Allotments below the forest boundary. The upper 1.4 miles of the reach is in the Horse Creek Allotment while the lower 3.4 miles is in the Uncle Ike allotment. The Horse Creek Allotment is managed as a 3 pasture, deferred rotation system. The Uncle Ike Allotment is a 4 pasture, modified deferred rotation system. The riparian zones are not excluded or protected from grazing. According to BLM, the present grazing regime–with a couple of localized exceptions–does not appear to be having a significant impact on the overall channel condition of Badger Creek (BLM personal communication 1998). The 1994 Challis National Forest travel map indicates 1 mile of restricted road use and 2 miles of closed roads up Badger Creek canyon.

Deer Creek

Deer Creek from the forest boundary to the confluence with the Little Lost River, a 3.8 mile section, is in the BLM Hawley Mountain Allotment. As mentioned previously, this Allotment is managed as a 10 pasture, modified rest rotation system. The Deer Creek pasture is grazed for two months in the winter generally between November to January. The riparian zones are not excluded or protected from the winter grazing. The 1994 Challis National Forest travel map indicates about 2 miles of restricted road use and 3 miles of closed roads near Deer Creek.

Little Lost River

The Little Lost River at Clyde is in the BLM Bell Mountain Allotment. This 1.1 mile section runs from approximately 0.5 miles above the Wet Creek confluence to 0.3 miles below the confluence. The Allotment is managed as a 5 pasture, rest rotation system. All of this stream section has been fenced for at least 10 years and no authorized grazing has been allowed. the upper 600 feet above the campground functions as a water gap for the lower end of the allotment. However, trespass grazing does frequently occur and at times heavily utilizes the herbaceous component of the reach (BLM personal communication 1998).

Middle Little Lost Watershed

Big Springs Creek

A 5-miles section of Big Springs Creek falls within the BLM Uncle Ike Allotment which is managed as a 4 pasture, modified deferred rotation system. The west bank is fenced to keep livestock grazing off of the riparian zone. However, three small, heavily utilized water gaps are present and are included in the totals and averages for this stream section. BLM states that these small reaches are managed as “sacrifice” areas for livestock watering and thus will continue to be in “non-functional” condition as long as grazing is authorized in the allotment (BLM personal communication 1998).

Little Lost River

The Little Lost River has about 1 mile that falls with the BLM Horse Creek Allotment which is managed as a 3 pasture, deferred rotation system. Although this reach of river is not fenced and livestock grazing is authorized, it is generally not grazed, or if anything, lightly grazed by wandering cattle due to its geographic location in relation to existing pastures. According to BLM, evidence of past extensive grazing are still evident (BLM personal communication 1998).

The next section of the river runs from below the Deer Creek confluence to the Deer Creek road crossing in the Hawley Mountain Allotment. This Allotment is a 10 pasture, modified rest rotation system. This 2.4 mile stretch of the Little Lost River falls within the Deer Creek pasture which receives winter grazing only. The riparian zone is not protected from grazing in this pasture. BLM states that even with a mixture of good and poor riparian elements, the evidence suggests this reach overall is showing a definite upward trend, especially in vegetative categories (BLM personal communication 1998).

The BLM Cedarville Allotment contains the next section of the river which runs downstream from Deer Creek road crossing for 4.2 miles. This Allotment is managed as a 3 pasture, deferred rotation system. The upper 2.4 miles are grazed as part of the deferred rotation system with no special riparian protection. The lower 1.8 miles are fenced and supposedly managed as a riparian pasture. Historically, it is also used for trailing and as a holding pasture. The BLM states that management needs to improve in this area. According to the agency's proper functioning condition ratings, this reach has the worst ratings in the entire Little Lost drainage. The BLM suggests that for any significant amount of recovery to occur, this entire reach needs to be in a riparian pasture with only very light, early season grazing. Trailing and holding pasture activities should be discontinued. The agency also noted that fish productivity is extremely limited (BLM personal communication 1998).

Lower Little Lost Watershed

Little Lost River

The Little Lost River below Big Spring Creek confluence to approximately 2 miles below the Howe sink trench diversion falls within the BLM Briggs Canyon and Jumpoff Allotment. The Briggs Allotment is managed as a single pasture, within the deferred rotation system of the Cedarville Allotment. A 0.7 mile reach of this section of the river falls within the Jumpoff Allotment which is managed as a 7 pasture, modified rest rotation system. The entire 6.4 mile reach is fenced on the east side with no authorized grazing on the west side. The reach is managed as a riparian pasture but in reality it functions as a livestock exclosure. Some minor grazing does periodically occur from wandering livestock. The lower 2.8 miles of this stream section (i.e., below the Fallert Springs confluence) is dewatered in the winter and diverted into "sink trenches" as part of the Howe flood control project (BLM personal communication 1998).

According to BLM, this reach of the Little Lost has several old (non-functional) and functional diversion structures. These structures locally impact the channel configuration, riparian condition and discharge for their associated reaches. The river below the flood trench diversion is virtually dewatered in the winter destroying the fishery in 10.5 miles of the Little Lost River. This loss of fishery was mitigated by a stream channel improvement project on 7 miles of Sawmill Creek (BLM personal communication 1998).

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4th and 5th field hydrologic units, IDWR
DEQ BURP sites, DEQ
§303(d) Streams, DEQ

GLOSSARY

Acre-foot - a volume of water that would cover an acre to a depth of one foot. Often used to quantify the annual discharge of large rivers

Adsorption - the adhesion of one substance to the surface of another; clays, for example, can adsorb phosphorus and organic molecules.

Aeration - a process by water gains oxygen directly from the atmosphere, the dissolved gas is then available for oxidation reactions in water.

Aerobic - describes life or processes that require the presence of oxygen.

Alevin - newly hatched salmonid still dependent on yolk sac; remains in streambed gravel until yolk sac is absorbed.

Algae - non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.

Alluvium - unconsolidated recent stream deposition.

Ambient - surrounding, external, or unconfined conditions.

Anadromous - Fishes, such as salmon and sea-run trout, that live part or the majority of their lives in the salt water but return to fresh water to spawn.

Anaerobic - describes processes that occur in the absence of molecular oxygen.

Anoxia - the condition of oxygen absence or deficiency

Anti-degradation - A Clean Water Act requirement that States protect waters which exceed state standards from reduction in existing quality. Waters standards may only be lowered to allow important social or economic development and only after adequate public participation. In all instances, the existing beneficial uses must be maintained.

Aquatic - occurring, growing, or living in water.

Aquifer - a water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding considerable quantities of water to wells or springs.

Assimilative Capacity - the ability to process or dissipate pollutants without ill-effect to beneficial uses. In the context of a TMDL it is an estimate of the maximum amount of pollutants that can be discharged to a waterbody and still meet the state water quality standard, the equivalent of a waterbody's Loading Capacity.

Autotrophic - an organism is considered autotrophic if it uses carbon dioxide as it main source of carbon, most commonly through photosynthesis.

Bedload - sand, silt, gravel, or soil and rock detritus carried by a stream on or immediately above (3") its bed.

Beneficial uses - any of the various uses which may be made of the water of an area, including, but not limited to, aquatic life (cold and warm water biota, salmonid spawning), water supply (domestic, industrial, agricultural), navigation, recreation in and on the water, wildlife habitat, and aesthetics.

Benthic organic matter - the organic matter on the bottom of the river.

Benthic - pertaining to or living on the bottom or at the greatest depths of a body of water.

Benthos - macroscopic (seen without aid of a microscope) organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the substrate.

Best Management Practice (BMP) - a measure determined to be an effective, practical means of preventing or reducing pollution inputs from nonpoint sources in order to achieve water quality goals.

Biochemical oxygen demand (BOD) - the amount of dissolved oxygen consumed by organisms during the decomposition (= respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.

Biomass - the weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often measured in terms of grams per square meter of surface.

Biota - All living things occurring in a specified area.

Cfs - cubic feet per second. A unit of measure for the rate of discharge of water. One cubic foot per second is the rate of flow of a stream with a cross section of one square foot flowing at a mean velocity of one foot per second. At a steady rate it is equal to 448.8 gallons per minute and 1.984 acre-foot per day.

Coliform bacteria - a group of bacteria predominantly inhabiting the intestines of man and animal but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms.

Colluvium - material transported to a site by gravity.

Decomposition - the breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and non-biological processes.

Depth fines- percent by weight of particles of small size within a vertical core volume of a stream bed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes has varied from 0.8 to 6.5 mm depending on observer and methogolgy used. The depth sampled varies but is typically about 1 foot (30cm).

Designated Beneficial Use or Designated Use - Those beneficial uses assigned to identified waters in Idaho Department of Health and Welfare Rules, Title 1, Chapter 2, "Water Quality Standards and Wastewater Treatment Requirements:, Sections 110. through 160. and 299., whether or not the uses are being met.

Dissolved - for most chemical analyses of water (metals, forms of phosphorus) this is operationally defines as all material passing through a 0.45 micron filter.

Dissolved oxygen - commonly abbreviated D.O., it is the amount of oxygen dispersed in water and is usually expressed as mg/L (ppm). The maximum amount of oxygen dissolved in water, termed saturation, is affected by temperature, atmospheric pressure (thus elevation), and total dissolved solids.

Ecology - scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.

Ecosystem - a complex system composed of a community of flora and fauna taking into account the chemical and physical environment with which the system is interrelated; ecosystem is often defined to include a body of water and its watershed.

Effluent - a discharge into the environment; often used to refer to discharge of untreated , partially treated, or treated pollutants into a receiving water body.

Environment - collectively, the surrounding conditions, influences, and living and inert matter that affect a particular organism or biological community.

Eolian - windblown, referring to the process of erosion, transport, and deposition of material by the wind

Ephemeral stream - a drainage channel which is normally dry but carries water in response to storms or annual snowmelt

Erosion - the wearing away of areas of the earth's surface by water, wind, ice, and other forces. **Culturally-induced erosion** is that caused by increased runoff or wind action due to the work of man in deforestation, cultivation of the land, overgrazing, and disturbance of the natural drainage; the excess of erosion over that normal for the area.

Eutrophic - from Greek for "well-nourished", describes a body of water in which nutrients do not limit algal growth, typified by high algal densities and low clarity.

Eutrophication - the natural process of physical, chemical, and biological changes in a waterbody associated with nutrient, organic matter, and silt accumulation. If this process is accelerated by man-made influences, it is termed cultural eutrophication. Eutrophication commonly refers to the effects of added nutrients.

Existing Beneficial Use or Existing Use - Those beneficial uses actually attained in waters on or after November 28, 1975, whether or not they are designated for those waters in Idaho Department of Health and Welfare Rules, Title 1, Chapter 2, "Water Quality Standards ad Wastewater Treatment Requirements."

Fecal Streptococci - a species of spherical bacteria including pathogenic strains found in the intestines of warm blooded animals.

Feedback Loop - a component of a watershed management planning that provides for tracking progress toward goals and revising actions according to that progress.

Flow - the water that passes a given point in some time increment.

Gradient - the slope of the land, water or streambed surface.

Groundwater - water found beneath the soil surface saturating the stratum in which it is located. Most groundwater originates as rainfall, is free to move under the influence of gravity, and usually emerges again as streamflow.

Growth Rate - a measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time, or number of individuals added to a population.

Habitat - a specific type of place that is occupied by an organism, a population or a community.

Headwater - the origin or beginning of a stream.

Hydrologic basin - the area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area. Also known as a watershed.

Hydrologic cycle - the cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, groundwater, and water infiltrated in soils are all part of the hydrologic cycle.

Hydrologic Unit - one of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The intial 1974 effort (USGS, 1978) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States, with the fourth level uniquely identified by an eight-digit code built-up of two-digit fields for each level in the classification. Originally termed a catologing unit, fourth field Hydrologic Units have been more commonly called subbasins. Fifth and sixth field Hydrologic Units have since been delineated for much of the country and are known as watersheds and subwatersheds respectively.

Impervious - describes a surface, such as a pavement, that rain cannot penetrate.

Influent - a tributary stream.

Inorganic - materials not derived from biological sources.

Intermittent stream - a stream which flows for at least a month each year but ceases to flow during a portion of most year. Idaho adminstratives rules define a intermittent stream as having zero flow for at least a week during most years or, if discharge records are available, a 7Q10 flow less than 0.1 cfs; streams with perennial pools are not considered intermittent.

Irrigation return flow - surface and subsurface water which leaves the field following the application of irrigation water and eventually runs into streams

Land Application - a process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or groundwater recharge.

Limiting - a chemical or physical condition that determines the growth potential of an organism, can result in complete inhibition of growth, but typically results in less than maximum growth rates.

Limnology - scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes.

Load Allocation (LA) - the amount of pollutant that a nonpoint source can release to a waterbody.

Load(ing) - the quantity of a substance entering a receiving stream, usually expressed in pounds (kilograms) per day or tons per year. Loading is calculated from flow (discharge) times concentration.

Loading Capacity (LC) - a determination of how much pollutant a waterbody can safely receive over a given time period without violating state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a TMDL.

Loam - refers to a soil with a range of textures resulting from a relative balance of sand, silt and clay. This balance imparts many desirable characteristics for agricultural use

Loess -is defined as a uniform eolian (wind-blown) deposit of silty material. Silty soils are among the most highly erodible.

Luxury consumption - a chemical phenomenon in which sufficient nutrients are available in either the sediments or the water column of a waterbody, and the aquatic plants take up and store an abundance in excess of the plant's current needs.

Macroinvertebrates - aquatic insects, worms, clams, snails, and other animals visible without aid of a microscope, that may be associated with or live on substrates such as sediments and macrophytes. They supply a major portion of fish diets and consume detritus and algae.

Macrophytes - rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seed. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.

Margin of safety (MOS) - an implicit or explicit component of a waterbody's Loading Capacity that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving waterbody. This is a required component of a TMDL and is normally incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.

Mean - describes the central tendency of a set of numbers, the **arithmetic mean** is the statistic familiar to most people. The mean is calculated by summing all the individual observations or items of a sample and dividing this sum by the number of items in the sample. The geometric mean is used to describe highly variable, right skewed (a few large values) data such as bacterial numbers. The **geometric mean** is a back-transformed mean of the logarithmically transformed numbers.

Meter - the basic metric unit of length; 1 meter = 39.37 inches or 3.28 feet.

Milligrams per liter (mg/L) - a unit of measure for concentration, essentially equivalent to part per million (ppm) in water. See parts per million.

Million gallons per day (MGD) - a unit of measure for the rate of discharge of water**,** often used to measure flow at wastewater treatment plants (WWTPs). It is equal to 1.547 cubic feet per second.

Monitoring - the process of watching, observing, or checking (in this case water). The entire process of a water quality study including: planning, sampling, sample analyses, data analyses, and report writing and distribution.

Mouth - the location where flowing water enters into a larger waterbody.

National Pollution Discharge Elimination System (NPDES) - a national program for permitting point sources of pollution established by the Clean Water Act. This program provides for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing discharge permits, and imposing and enforcing pretreatment requirements.

Nitrogen - a nutrient essential to plant growth, often in more demand than available supply.

Nonpoint source - a dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in water applied to or incident on that area, and the resultant mixture then delivered into waters of the state. Nonpoint sources include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites. By definition septic tank disposal fields are also included.

Nuisance - anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.

Nutrient - an element or chemical essential to life, such as carbon, oxygen, nitrogen, and phosphorus.

Nutrient cycling - the flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).

Oligotrophic - "poorly nourished," from the Greek, describes a body of water in which nutrients are limiting to algal growth, typified by low algal density and high clarity.

Organic matter - compounds manufactured by plants and animals which contain principally carbon with elements such as hydrogen, oxygen, nitrogen, sulfur, and phosphorus.

Orthophosphate - a form of soluble inorganic phosphorus which is directly utilizable for algal growth.

Oxygen-demanding materials - those materials, mainly organic matter, in a waterbody which consume oxygen during decomposition. Sediment can be an oxygen-demanding material ("anaerobic sediment").

Parameter - a variable quantity such as temperature, dissolved oxygen, or fish population, that is the subject of a survey or sampling routine.

Partitioning - the sharing of limited resources by different races or species; use of different parts of the habitat, or the same habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between water column and sediment.

Pathogen - any disease-producing organism.

Perennial stream -a stream which flows year round in most years.

Periphyton - organisms, typically algae, attached to rocks or other submersed substrates (such as macrophytes) above the bottom sediments in a waterbody.

pH - the negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH = 1) to very alkaline (pH = 14). A pH of 7 is neutral and values less than 7 are considered acidic. Surface waters usually measure between pH 6 and 9, and most life forms cannot survive at pH of 4.0 or less.

Phased TMDL - A TMDL which identifies interim load allocations and details further monitoring to gauge success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a waterbody. Under a phased TMDL, a refinement of load allocations, wasteload allocations, and the margin of safety is planned at the outset.

Phosphorus - a nutrient essential to plant growth, typically in more demand than the available supply.

Plankton - microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.

Point source pollution - a source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable ‘point’ of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.

Pretreatment - the reduction in amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.

Primary productivity - the rate at which algae and macrophytes fix carbon dioxide, using light energy. Commonly measured as milligrams of carbon per square meter per hour.

Reach - a stream section with fairly homogenous physical characteristics.

Respiration - process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process releases energy, carbon dioxide, and water.

Riffle - A relatively shallow, gravelly area of streambed with locally faster current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.

Riparian - associated with aquatic (streams, rivers, lakes) habitats. Living or located on the bank of a waterbody.

Runoff - the portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through groundwater and into streams.

Sediment - deposits of material on the bottom of waterbody. Usually consists of mostly inorganic particles resulting from erosion of surrounding lands, but can contain remains of aquatic organism, organic matter from the land, and chemical precipitates.

Settleable solids - the volume of material that settles out of a liter of water in one hour.

Specific conductance - also known as specific conductivity. The ability of an aqueous solution to carry electric current, expressed in Fmhos/cm at 25EC. Specific conductivity is affected by dissolved minerals and is used as an indirect measure of total dissolved solids in a water sample.

Stagnation - the absence of mixing in a waterbody

Stream Segments of Concern (SSOCs) - Stream segments nominated by the public and designated by a committee whose members are appointed by the Governor.

Stormwater runoff - rainfall that quickly washes off the land after a storm. In developed watersheds it flows off roofs and pavement into storm drains which may feed directly into the stream; often carries pollutants picked up from these surfaces.

Subbasin - a large watershed of several hundred thousand acres, name commonly given to 4th field Hydrologic Units under 1974 national watershed delineation and mapping effort.

Subwatershed - smaller watershed area delineated within a larger watershed, often for purposes of describing and managing more localized conditions. Also proposed for adoption as the formal name for 6th field Hydrologic Units.

Surface fines- sediments of small size deposited on the surface of a stream bed or lake bottom. The upper size threshold for fine sediment for fisheries purposes has varied from 0.8 to 6.5 mm depending on observer and methogolgy used. Results are typically expressed as a percentage of observation points with fine sediment.

Suspended sediments - fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. Causes turbidity and, when deposited, reduces living space within streambed gravels and can cover fish eggs or alevins.

Thalweg - the center of a stream's current, where most of the water flows.

Threatened species - species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

TMDL - Total Maximum Daily Load. TMDL = LC = LA + WLA + MOS. A TMDL is the Loading Capacity after it has been allocated among sources. Can be expressed on a time basis other than daily if appropriate, sediment loads, for example, are often calculated on an annual basis.

Total suspended solids (TSS) - the dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (1995) call for using a filter of 2.0 micron <u>or smaller</u>, often a 0.45 micron filter is used (see dissolved). This method calls for drying at a temperature of 103-105 °C.

Tributary - a stream feeding into a larger stream or lake.

Trophic state - level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.

Turbidity - a measure of the extent to which light passing through water is scattered by fine suspended materials, the finer the particles the greater the effect per unit weight. Turbidity reduces light penetration and thus can reduce photosynthesis and thereby cause a decrease in productivity. High turbidity may alter water temperature and interfere directly with essential physiological functions of fish and other aquatic organisms, making it difficult for fish to locate a food.

Vadose zone - the unsaturated region from the soil surface to the groundwater table.

Waste Load Allocation (WLA) - the portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Waste load allocations specify how much pollutant each point source may release to a waterbody.

Water column - water between the interface with the air at the surface and the interface with the sediment layer at the bottom. Idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.

Water Pollution - any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental or injurious to public health, safety or welfare, or to fish and wildlife, or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.

Water Quality Limited Segment (WQLS) - any segment where it is known that water quality does not meet applicable water quality standards, and/or is not expected to meet applicable water quality standards.

Water Quality Management Plan - a state or areawide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.

Water quality modeling - the input of variable sets of water quality and associated environmental (e.g. climate, streamflow) data to predict the response of a lake or stream to changes in these variables.

Water table - the upper surface of groundwater; below this point, the soil is saturated with water.

Watershed - a drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation. The whole geographic region contributing to a water body.

Wetlands - lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands typically have the following three attributes: (1) at least periodically, the land supports predominately hydrophytes; (2) the substrate is predominately undrained hydric soil; and (3) the substrate is on soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

Young of the year - young fish born the year captured and evidence of spawning activity.

APPENDIX A. CLIMATE OF LITTLE LOST RIVER SUBBASIN

Data for the following discussion were obtained or summarized from several sources. Howe and Mackay RS climate data were obtained online from Western Regional Climate Center website at: *http://www.wrcc.sage.dri.edu/summary/climsmid.html.* Long term temperature mean and departures were calculated using Idaho climatic region 8 historical climate data obtained online from National Climatic Data Center - ClimVis regional data summaries, at website: *http://www/ncdc.noaa.gov/onlineprod/drought/xmgrg3.html.* Discussion of subbasin precipitation was based on areal zones in the GIS cover Precip95 obtained from Idaho Climate Service at University of Idaho. Moonshine snowcourse data was obtained from page 1-1 of the Sawmill Canyon Watershed Analysis prepared by the Salmon/Challis National Forest.

The only regular weather reporting station in the Little Lost River subbasin is at Howe. At Howe summers are short but hot, temperatures over 90 °F are common in July. Winters are long with daytime freezing temperatures the rule in December and January. From 1948 through 1997 frost has occurred in every month but July and the frost-free growing season has ranged from 65 to 154 days. Over this same period the average maximum temperature in July has been 86.5 °F and the average minimum in January 6.1 °F. Figure 17. shows the seasonal progression of average monthly air temperatures.

Stream temperatures follow the same general seasonal progression as air temperature as well as responding to diurnal, day to day, and year to year flucuations in air temperature and cloud cover. Thus, the critical time for high stream temperatures is in late July to early August but with considerable dependence on the weather of a given day and year.

A history of annual mean temperatures provides a gage to warm years and cool years and is useful in putting stream temperature data into perspective. The only long term records readily accessible were averages for all reporting stations in Idaho climatic division 8, consisting of eastern Idaho valleys including Little, and Big Lost, Pashimeroi, Lemhi, and Birch Creek valleys. Figure 18. shows a record of annual mean temperatures for all reporting stations in this region as the departure from the long term (1895-1997) mean.

It can be seen in Figure 18. that since 1984 every year except 1993 has been warmer than the long term average. By this regional measure, 1992 was the warmest year in recent history at 2.5 °F above the division mean of 41.4 °F, and 1988, at 2.2 °F above normal, is a close second. Mean annual temperature at Howe is 2.3 °F above the 1895-1997 divisional mean indicating that Howe and the lower Little Lost subbasin is a warmer than the average reporting station in this area. Temperatures are of course cooler in the mountains and stream temperatures would be expected to be correspondingly cooler in the mountains and warmer in the valleys.

For the period 1948 through 1997 precipitation at Howe averaged 8.54 inches annually, and annual snowfall averaged 15 inches. Annual precipitation of less than ten inches is generally considered a threshold for desert conditions. The two wettest months of the year, May and June, both average a Little over an inch of rainfall. Figure 19. depicts the average annual distribution of precipitation at Howe.

Although the valley bottom qualifies as a cool desert, precipitation increases markedly with elevation in the mountains. An indication of conditions further up the valley near Clyde can be obtained from weather records for Mackay Ranger Station which occupies a similar position and elevation in the Big Lost River drainage adjacent to the west. At Mackay the mean annual temperature for the period 1931 through 1997 is 41.9 °F, about 2 °F cooler than at Howe. Annual precipitation at Mackay averages about an inch greater, but with the cooler temperatures snowfall nearly doubles to 29 inches (Figure 20.).

In the Lost River Range at the head of the Wet Creek watershed, in the vicinity of Warren Mountain, precipitation exceeds 35 inches per year. The mountains to eastern side of the subbasin are somewhat drier with precipitation barely reaching 30 inches per year along the divide at the headwaters of Sawmill Creek north of Clyde. This reflects the general eastward track of storms off the Pacific and the depletion of airmass moisture content by mountains to the west. The Moonshine snow course at 7440 feet in the middle of the Sawmill watershed averaged 24.8 inches of precipitation from 1961 to 1985. The majority of mountain precipitation falls as snow accumulating to sustain later spring and summer snowmelt runoff.

Streamflow affects stream temperature because water flows more slowly at lower discharge and the surface to volume ratio increases. Annual streamflow is of course highly dependent on annual precipitation. Annual precipitation recorded at Howe has been as low as 4.47 inches in 1956, and as high as 12.13 inches in 1968. Streamflow also affects energy available for sediment transport. Actual streamflow records will be examined later in this section.

Figure 17. Air Temperature at Howe, Idaho

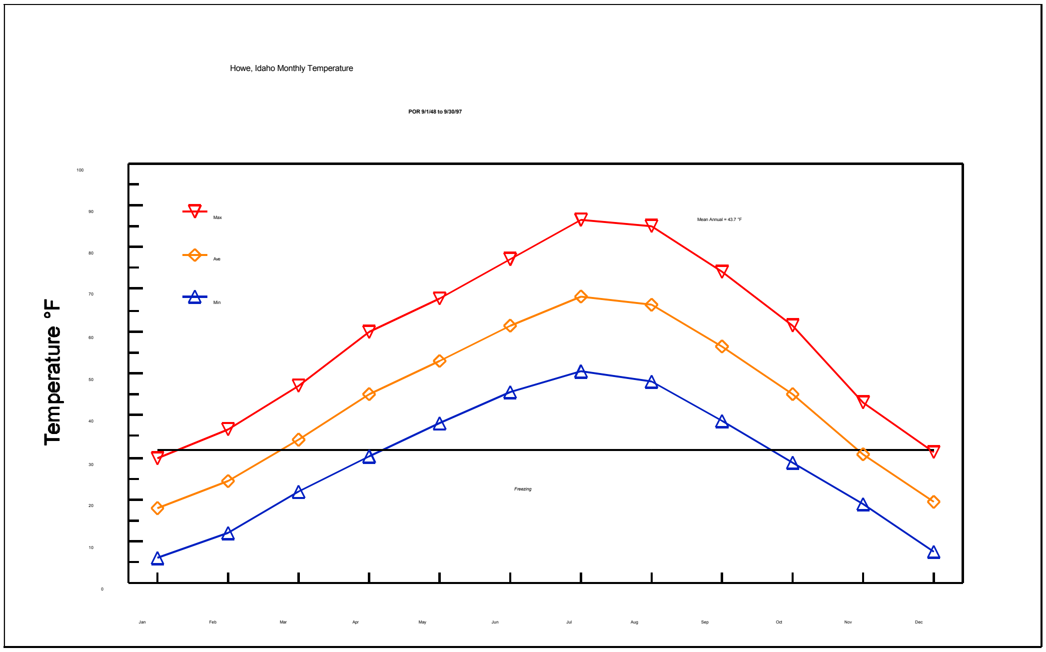


Figure 18. Departure of Annual Mean Temperatures from Normal

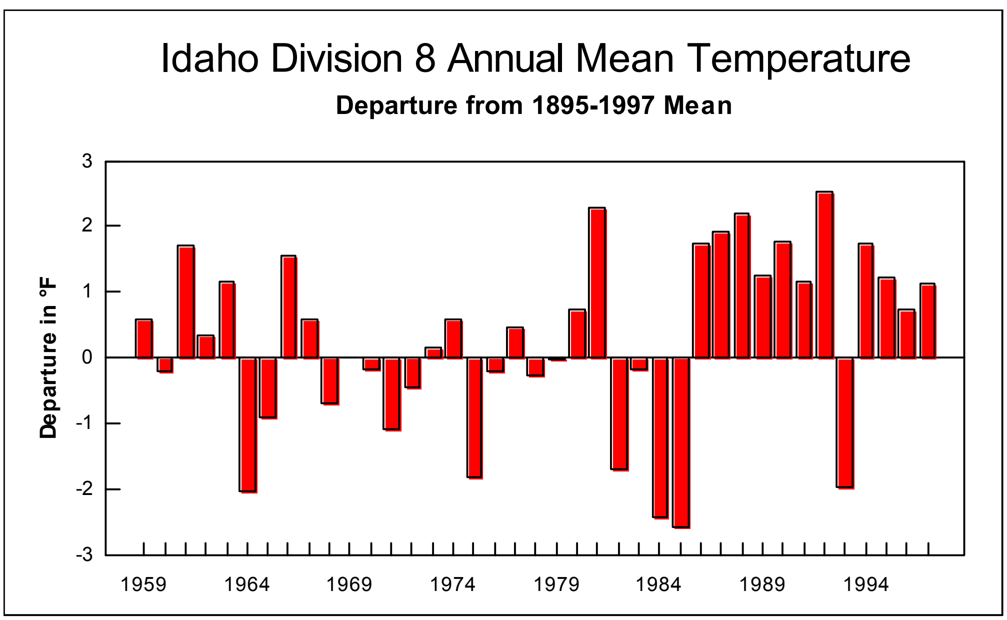


Figure 19. Precipitation at Howe, Idaho

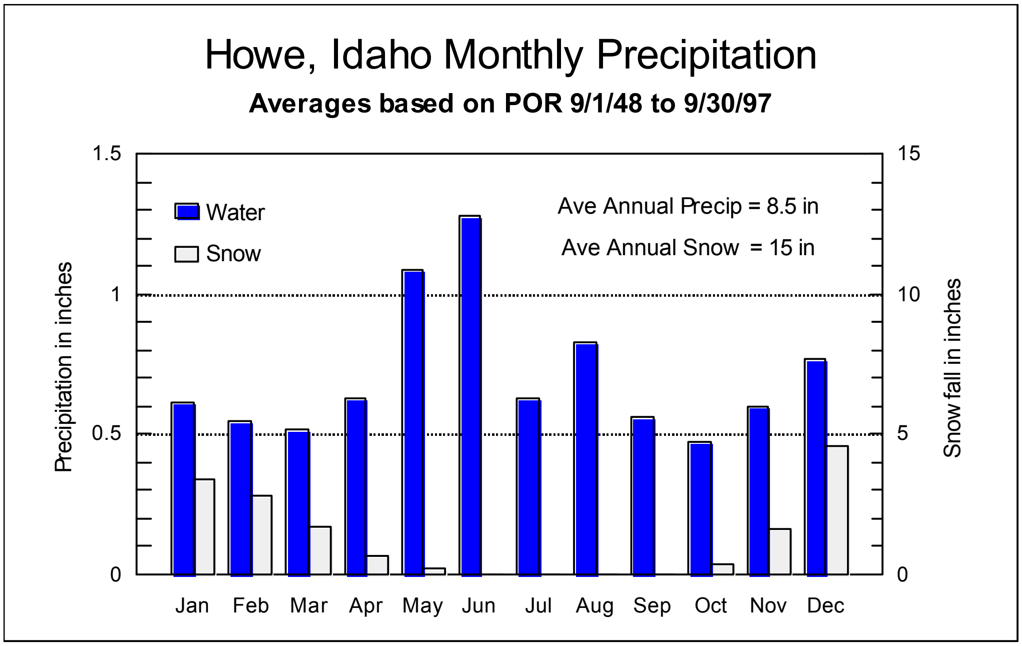
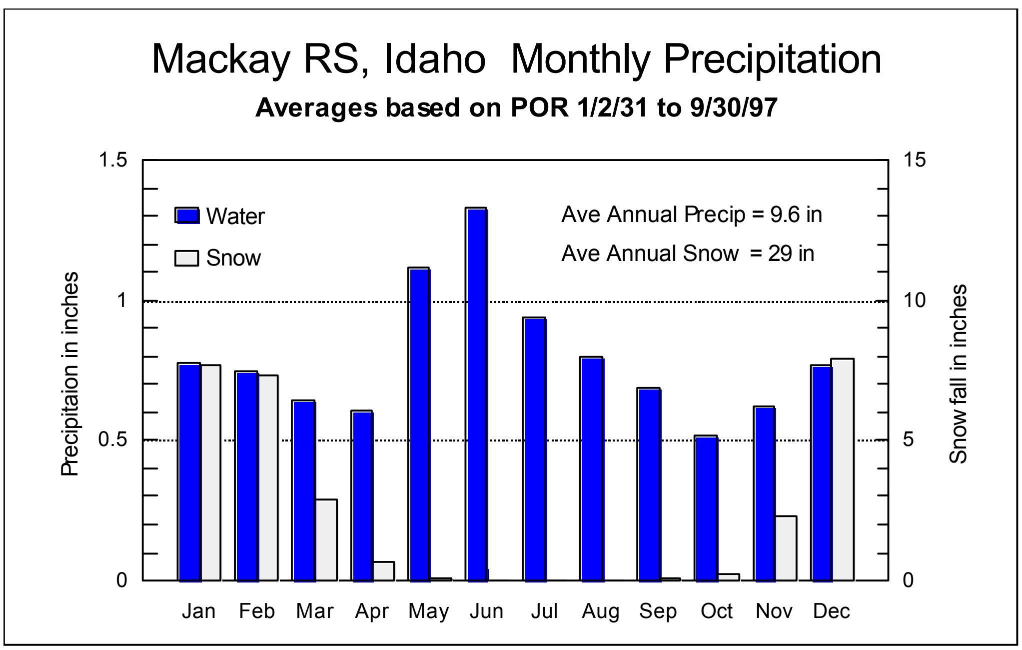


Figure 20. Precipitation at Mackay Ranger Station, Idaho



APPENDIX B - HYDROLOGY OF LITTLE LOST RIVER

The USGS has operated eight stream gaging stations in the Little Lost River subbasin over the years (Figure 21.). Only the Little Lost River below Wet Creek station (13118700), 27 miles northwest of Howe, is still active (Table 25.). A second station (13119000), is located seven miles northwest of Howe and just upstream of the Blaine County Investment Company's diversion dam. This lower station was operated for 46 years prior to 1991. Another diversion dam was completed 1 mile upstream of this latter station in December 1984 for purposes of winter flood control. Below this dam all flow is now diverted from the Little Lost River channel for most of the period from December through February each year.

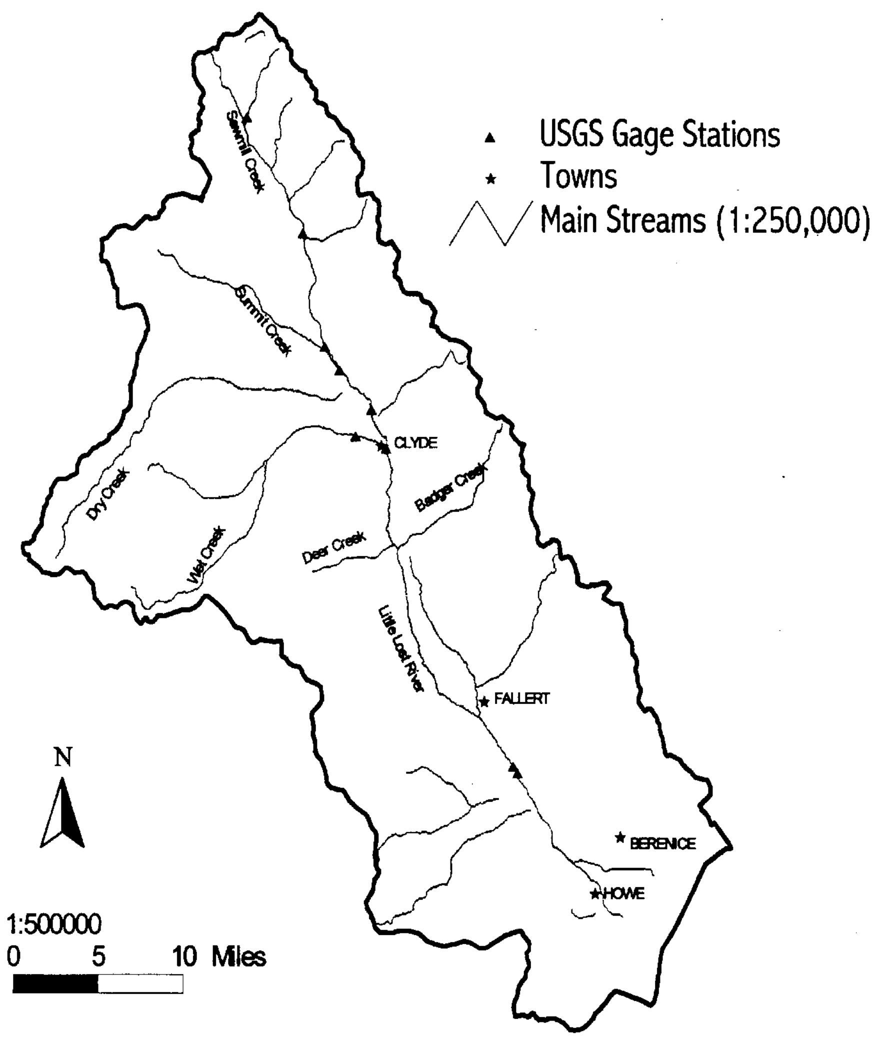
Table 25. USGS Gaging Stations in Little Lost Subbasin

Station #	Name	Drainage Area (mi^2)	Period of record
13117300	Sawmill Creek near Goldburg	74	1960-73
13117360	Sawmill Creek above Summit Creek near Clyde	107	1982-89
13117500	Little Lost River near Clyde	275	1910-1913
13118000	Little Lost River at Raymond Ranch near Howe	305	1921-1924
13118500	Wet Creek at Clyde School near Howe	115	1921-22
13118700	Little Lost River below Wet Creek near Howe	440	1958-**present**
13119000	Little Lost River near Howe	703	1921-82, 1985-91
13119500	Blaine County Investment Co. Canal near Howe	na	1924-78

Figure 22. shows the average annual runoff hydrograph for stations 13118700 and 13119000 based on mean monthly discharge over their respective periods of record. Both hydrographs display a typical Northern Rockies snowmelt peak in June. At the below Wet Creek station 54% of the average annual runoff occurs during the 3 months of May through July. Downstream, at the near Howe station, 45% of the average annual runoff occurs during these same three months, reflecting the higher baseflows further downstream.

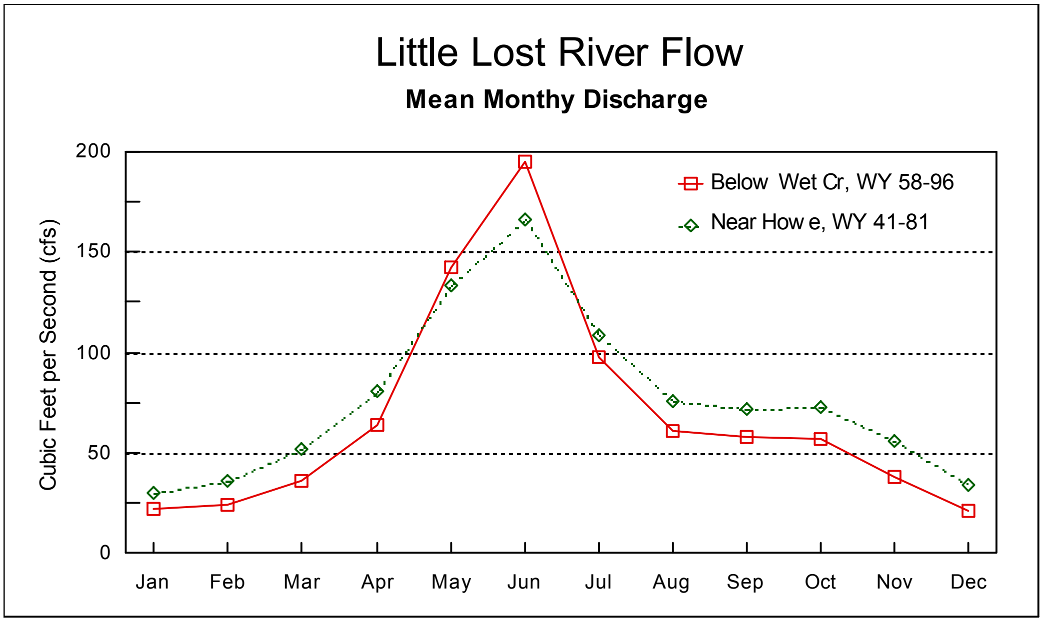
Inspection of daily records not presented here shows annual runoff at both these stations typically peaks the first week of June. Flows remain near the annual average discharge value (68 cfs for 13118700 and 77 cfs for 133119000) throughout the summer with monthly average low

Figure 21 - Hydrology



Little Lost River Subbasin - 4th Field HUC

Figure 22. Little Lost River Streamflow



flow of 20-30 cfs typically occurring in mid-winter. Minimum recorded flow at both stations has occurred in mid-December.

Streamflow at the lower station is greater, by 10-20%, during all but the summer months. An increase in flow downstream is expected in most streams in the absence of diversions or other water losses. The apparent decrease in flow downstream during May and June might be attributed to irrigation diversions, although given the climate irrigation demand in May and June would be less than later in the summer. It could also represent annual loss of water to recharge the alluvial aquifer, or perhaps measurement errors. Interpretation is confounded by the differing periods of record. To overcome the difference in periods of record, Figure 23. compares the annual hydrograph for both stations for water year 1981, a near average runoff year. The seasonal pattern is similar but with a less marked loss of water downstream in early summer.

Annual runoff below Wet Creek near Howe (13118700) has averaged 49,000 acre-feet for the period 1958 through 1996. This represents a meager 2.1 inches of runoff from 440 square miles, (about 45% of the entire subbasin) discounting diversions above this station for irrigation of about 3800 acres (1966 estimates).

At the lower station (13119000) annual runoff averaged 55,500 acre-feet for the combined 46 years of record. This is about an 11% increase in annual runoff over the upper site below Wet Creek for a 60% increase in drainage area (703 mi^2). According to 1966 USGS estimates 11,500 acres are irrigated by diversions above this station, of which 3900 acres are irrigated by surface water. Assuming 2 feetof water applied per acre about 7800 acre-feet are diverted. Adding this back into measure surface discharge gives 62,800 acre-feet per year on average, or about 1.67 inches of runoff.

Figure 23. Little Lost River Streamflow WY 1981

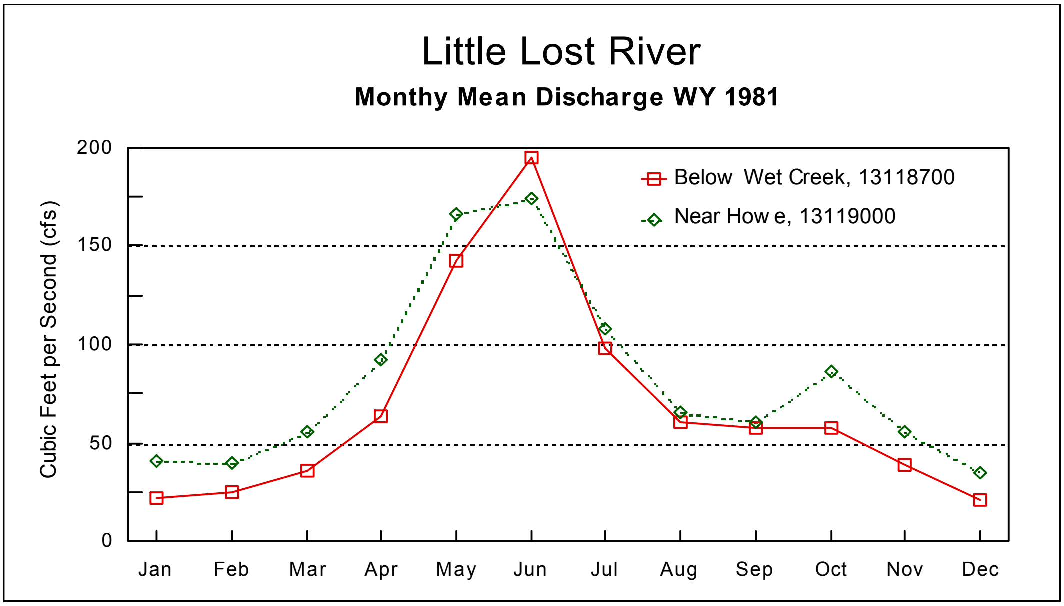
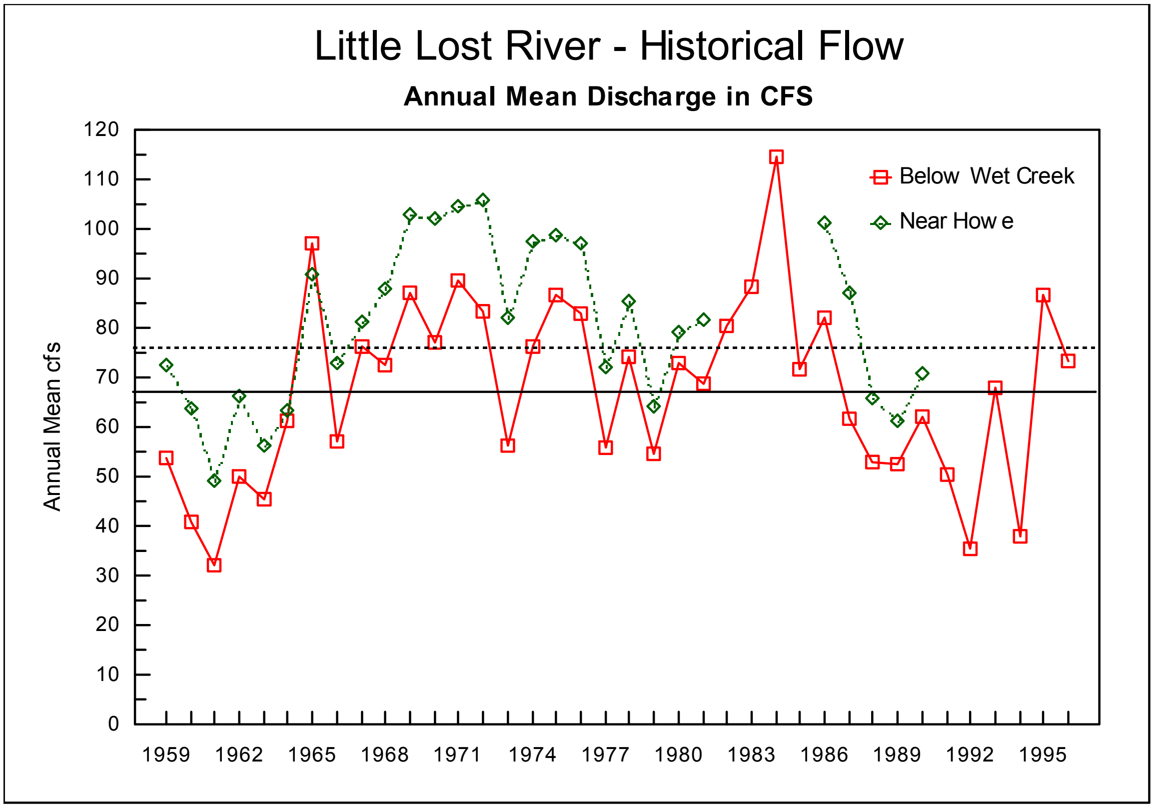


Figure 24. shows the historical variation in annual average flows since water year 1959. The solid line in this graph represents the average annual flow of 68 cfs over the period of record for the Little Lost River below Wet Creek station and the dashed line is at the average of 77 cfs for the station at Howe. These provide a reference for indicating the occurrence of wt and dry years. From this figure it can be seen that two of the driest years on record, 1992 and 1994, have occurred since 1990.

Water year 1992 (10-1-91 through 9-30-92) saw runoff that was 52% of the period of record average. the lowest flow of 7.8 cfs occurred on Nov. 30, 1991 while summer flows bottomed out at 23 cfs on Aug. 11, 1992. Runoff in water year 1994 was 56% of average, with a low flow of 12 cfs on Nov. 25-27, 1993 and a summer minimum of 20 cfs on Sep. 7-11, 1994.

Figure 24. Historical Annual Mean Flow of Little Lost River



APPENDIX C. 1994-1996 SALMONID INSTANTANEOUS TEMPERATURE CRITERIA EXCEEDANCES.

Tables 26., 27., and 28. summarize the frequency and magnitude of exceedances of the Idaho 13 °C intantaneous salmonid spawning criterion for brook trout, bull trout, and rainbow trout that ere recorded in 1994, 1996, and 1996 respectively.

Table 26. 1994 exceedances of the 13EC salmonid spawning temperature criterion*.

Stream and Species	WBID	Days/Yr	Max. # of EC Over	Date of Max. Exceed.
Little Lost River - below Big Spring Creek	2			
rainbow trout		57	9	22 Jun
Little Lost River - at Clyde	9			
rainbow trout		53	9	11 Jul
brook trout		no data		
bull trout		20	4	4 Sep
Sawmill Creek - near Summit Creek	12			
rainbow trout		45	12	13 Jul
brook trout		no data		
bull trout		19	6	7 Sep
Sawmill Creek - at forest boundary	14			
rainbow trout		34	8	11 Jul
brook trout		no data		
bull trout		13	3	2 Sep
Wet Creek - at Clyde	22			
rainbow trout		37	7.5	11 Jul
brook trout		0		
bull trout		28	4.5	10 Sep
Wet Creek - at Deer Creek road crossing	22			
rainbow trout		49	8	7 Jul
brook trout		1	4	1 Oct
bull trout		26	4	7 Sep

* Entries of “no data” indicate the species exists in the stream but the thermograph period of record did not include the spawning season for that species.

Table 27. 1995 exceedances of the 13EC salmonid spawning temperature criterion.

Stream and Species	WBID	Days/Yr	Max. # of EC Over	Date of Max. Exceed.
Big Creek - immediately above Wet Creek	24			
rainbow trout		11	2	20 May
brook trout		0		
bull trout		5	2	3 Sep
Little Lost River - below Big Spring Creek	2			
rainbow trout		36	4.5	7 Jul
Little Lost River - at Clyde	9			
rainbow trout		31	6	7 Jul
brook trout		0		
bull trout		15	5	4 Sep
Sawmill Creek - near Summit Creek	12			
rainbow trout		17	5	7 Jul*
brook trout		0		
bull trout		21	10	2 Sep
Sawmill Creek - at forest boundary	14			
rainbow trout		6	1	14 Jul
brook trout		0		
bull trout		10	4	1 Sep
Sawmill Creek - below Timber Creek	14			
rainbow trout		0		
bull trout		1	<1	5 Sep
Sawmill Creek - below Iron Creek	14			
rainbow trout		0		
brook trout		0		
bull trout		1	<1	4 Sep
Summit Creek - at county line	19			
rainbow trout		47	10	27 Jun
brook trout		0		
bull trout		17	6	3 Sep

Stream and Species	WBID	Days/Yr	Max. # of EC Over	Date of Max. Exceed.
Wet Creek - at Deer Creek road crossing	22			
rainbow trout		34	5	6 Jul
brook trout		0		
bull trout		13	3.5	3 Sep

* Break in thermograph recording

Table 28. 1996 exceedances of the 13EC salmonid spawning temperature criterion.

Stream and Species	WBID	Days/Yr	EC Over	Max. Date	Last Date
Big Creek - immediately above Wet Creek	24				
rainbow trout		15	5	7 Jul	15 Jul
brook trout		0			
bull trout		0			
Iron Creek - just above Iron Creek road	14				
bull trout		0			
Mill Creek - at trailhead	14				
rainbow trout		no data			
brook trout		0			
bull trout		0			
Wet Creek - at forest boundary	24				
rainbow trout		10*	6	15 Jul	15 Jul
brook trout		0			
bull trout		7	<1	1 Sep	14 Sep
Wet Creek - 0.8 km above Hilts Creek	24				
rainbow trout		0			
brook trout		0			
bull trout		0			

APPENDIX D. 1997 SALMONID SPAWNING AND BULL TROUT TEMPERATURE CRITERIA EXCEEDANCES.

Table 29. 1997 Exceedances of the salmonid spawning and bull trout criteria.

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Badger Creek - at BLM/FS boundary	8							
salmonid spawning (rainbow)		38	0			0		
Idaho bull trout [2]		85 / 40	0			0		
EPA bull trout[3]		109	4	<1[4]	26 Jul			
Badger Cr. - at Little Lost/ Pahsimeroi Rd	8							
salmonid spawning (rainbow)		39	12	1	19 Jun	32	2	09 Jul
Idaho bull trout		86 / 40	0			15	2	10 Sep[5]
EPA bull trout		110	100	4	26 Jul			
Basin Creek - ~50 m above Wet Creek	24							
salmonid spawning (rainbow + brook)[6]		40 + 23	36 + 2	11 / 5	05 Jul / 02 Oct	38 + 1	7 / 5	09 Jul / 02 Oct
Idaho bull trout		87 / 53	64	6	04 Aug	20	5	10 Sep
EPA bull trout		111	111	13	28 Jul			
Bear Creek -~50 m above Sawmill Creek	16							
salmonid spawning (rainbow)		45	19	5	08 Jul	20	3	15 Jul
Idaho bull trout		92 / 37	38	3	24 Aug	21	5	10 Sep
EPA bull trout		116	111	9	27 Aug			

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Big Creek - ~100m below Big Cr. Pond	24							
salmonid spawning (rainbow + brook)		42 + 9	0 + 0			0 + 0		
Idaho bull trout		89 / 39	0			0		
EPA bull trout		113	71	2	10 Jul			
Big Creek - at Wet Cr./Pass Cr. Road	24							
salmonid spawning (rainbow + brook)		40 + 23	22 + 0	3	15 Jul	19 + 0	2	9 Jul
Idaho bull trout		87 / 53	0			8	1	10 Sep
EPA bull trout		117	111	5	26 Jul			
Big Creek - at FS/private property bndry	24							
salmonid spawning (rainbow + brook)		40 + 7	19 + 0	4	7 Jul	15 + 0	1	9 Jul
Idaho bull trout		87 / 37	0			4	<1	2 Sep
EPA bull trout		111	111	5	10 Jul			
Big Springs Creek - at BLM/private property boundary near source	3							
salmonid spawning (rainbow + brook)		27 + 24	24 + 2	5 + 1	19 Jun + 2 Oct	26 + 2	3 + <1	27 Jun + 2 Oct
Idaho bull trout		74 / 54	2	< 1	17 Jul	24	2	10 Sep
EPA bull trout		na						

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Big Springs Creek - ~100m above Little Lost Rive	3							
salmonid spawning (rainbow + brook)		28 + 24	28 + 1	7 + 1	9 Jul + 2 Oct	28 + 2	6 + 2	9 Jul + 2 Oct
Idaho bull trout		75 / 54	70	4	17 Jul	31		
EPA bull trout		na						
Coal Creek - ~10m above Wet Creek	24							
salmonid spawning (rainbow + brook)		43 + 22	29 + 2	6 + 2	15 Jul + 2 Oct	18 + 0	3	15 Jul
Idaho bull trout		90 / 52	18	2	4 Aug	15	4	10 Sep
EPA bull trout		114	114	10	27 Aug			
Deer Creek - ~200m below confluence of N & S Forks	25							
salmonid spawning (rainbow)		38	38	3	27 Jun	38	5	9 Jul
Idaho bull trout		85 / 40	85	2	4 Aug	40	4	10 Sep
EPA bull trout		na						
Deer Creek - at BLM/private boundary	25							
salmonid spawning (rainbow)		38	35	4	19 Jun	38	6	9 Jul
Idaho bull trout		85 / 40	76	4	4 Aug	29	5	10 Sep
EPA bull trout		na						

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Dry Creek - at FS boundary	21							
salmonid spawning (rainbow + brook)		21 + 7	0			0		
Idaho bull trout		68 / 37	0			0		
EPA bull trout		92	77	3	29 Aug			
Fallert Springs Creek - ~100m above Little Lost River	3							
salmonid spawning (rainbow + brook)		39 + 23	39 + 0	6	9 Jul	39 + 3	8	9 Jul
Idaho bull trout		86 / 54	86	6	17 Jul	33	6	10 Sep
EPA bull trout		na						
Iron Creek - ~5m above Sawmill Creek	14							
salmonid spawning (rainbow + brook)		20 + 6	0 + 0			0 + 0		
Idaho bull trout		67 / 36	0			2	1	10 Sep
EPA bull trout		91	71	3	28 Aug			
Little Lost River - ~500 m above Wet Cr.	10							
salmonid spawning (rainbow + brook)		39 + 23	30 + 0	5	10 Jul	38 + 2	7 + 1	9 Jul + 2 Oct
Idaho bull trout		86 / 53	67	5	22 Jul	31	5	10 Sep
EPA bull trout		110	110	8	26 Jul			

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Little Lost River - below Big Springs Cr.	2							
salmonid spawning (rainbow)		39	37	6	9 Jul	39	7	9 Jul
Idaho bull trout		na						
EPA bull trout		na						
Little Lost River - at Buck n' Bird Road	7							
salmonid spawning (rainbow)		13	11	4	15 Jul	13	6	9 Jul
Idaho bull trout		75 / 52	55	6	22 Jul	30	5	10 Sep
EPA bull trout		na						
Mill Creek - ~100 m above Sawmill Cr.	14							
salmonid spawning (rainbow + brook)		46 + 6	6 + 0	2	15 Jul	8 + 0	1	15 Jul
Idaho bull trout		92 / 36	2	1	24 Aug	14	3	10 Sep
EPA bull trout		116	102	6	28 Aug			
Sawmill Creek - at Bull Creek Road	14							
salmonid spawning (rainbow + brook)		45 + 6	6 + 0	2	15 Jul	11 + 0	2	15 Jul
Idaho bull trout		92 / 36	9	1	24 Aug	16	3	10 Sep
EPA bull trout		116	100	5	28 Aug			

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Sawmill Creek - at Sawmill Canyon Road	14							
salmonid spawning (rainbow + brook)		46 + 7	15 + 0	4	7 Jul	21 + 1	4 / <1	15 Jul / 2 Oct
Idaho bull trout		92 / 37	46	6	24 Aug	22	6	1 Sep
EPA bull trout		117	111	12	27 Aug			
Sawmill Creek - ~100m abv Summit Cr.	14							
salmonid spawning (rainbow + brook)		39 + 23	29 + 2	9 / 2	8 Jul / 2 Oct	33 + 2	6 / 1	9 Jul / 2 Oct
Idaho bull trout		86 / 53	59	5	22 Jul	25	5	10 Sep
EPA bull trout		110	110	11	26 Aug			
Sawmill Creek - ~1.5 km above Smithie Fork	17							
salmonid spawning (rainbow)		45	0			0		
Idaho bull trout		92 / 36	0			0		
EPA bull trout		117	66	2	27 Aug			
Sawmill Creek - ~200 m abv Timber Cr.	17							
salmonid spawning (rainbow)		45	0			8	1	9 Jul
Idaho bull trout		92 / 36	0			5	1	11 Sep
EPA bull trout		116	75	3	27 Jul			

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Sawmill Creek - ~400m blw Timber Cr.	14							
salmonid spawning (rainbow + brook)		45 + 0	4	1	15 Jul	9	1	9 Jul
Idaho bull trout		64 / 0	0					
EPA bull trout		58	40	4	27 Jul			
Sawmill Creek - ~500 m below Horse Lake Creek	14							
salmonid spawning (rainbow + brook)		46 + 7	10 + 0	3	15 Jul	14 + 0	3	15 Jul
Idaho bull trout		92 / 37	20	2	24 Aug	14	3	10 Sep
EPA bull trout		117	104	7	27 Aug			
Smithie Fork - ~100 m abv Sawmill Cr.	17							
salmonid spawning (rainbow)		45	9	2	15 Jul	11	2	9 Jul
Idaho bull trout		92 / 36	0			8	1	9 Sep
EPA bull trout		116	104	5	27 Aug			
Squaw Creek - ~75 m above Wet Creek	23							
salmonid spawning (rainbow)		40	31	4	19 Jun	39	2	19 Jun
Idaho bull trout		87 / 53	0			15	1	2 Sep
EPA bull trout		111	111	6	23 Jun			

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Squaw Creek - ~10 m above Sawmill Cr.	15							
salmonid spawning (rainbow + brook)		46 + 23	11 + 0	2	7 Jul	22 + 1	2 / <1	9 Jul / 2 Oct
Idaho bull trout		92 / 53	0			13	2	10 Sep
EPA bull trout		117	114	4	27 Jul			
Summit Creek - ~200 m blw Iron Springs	19							
salmonid spawning (rainbow + brook)		45 + 7	44 + 3	9 / 3	5 Jul / 2 Oct	45 + 2	7 / 2	5 Jul / 2 Oct
Idaho bull trout		92 / 37	86	4	5 Jul	31	6	9 Sep
EPA bull trout		116	116	10	11 Sep			
Summit Creek - ~800 m blw Sawmill Canyon Road crossing	19							
salmonid spawning (rainbow + brook)		20 + 7	20 + 0	9	8 Jul	20 + 2	9 / 2	9 Jul / 2 Oct
Idaho bull trout		67 / 37	64	7	22 Jul	30	6	9 Sep
EPA bull trout		91	91	10	25 Jul			
Summit Creek - ~100 m above Little Lost River	19							
salmonid spawning (rainbow + brook)		39 + 23	39 + 1	9 / <1	9 Jul / 2 Oct	39 + 2	9 / 2	9 Jul / 2 Oct
Idaho bull trout		86 / 53	85	7	22 Jul	31	6	10 Sep
EPA bull trout		110	110	10	25 Jul			

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Summerhouse Canyon Creek - ~1.5 km below FS boundary	19							
salmonid spawning (rainbow + brook)		20 + 7	17 + 2	6 / <1	8 Jul / 2 Oct	18 + 2	4 / 1	15 Jul / 2 Oct
Idaho bull trout		67 / 37	35	2	22 Jul	19	4	10 Sep
EPA bull trout		91	91	8	27 Jul			
Timber Creek - ~50 m abv Sawmill Cr.	18							
salmonid spawning (rainbow)		45	1	1	15 Jul	8	1	15 Jul
Idaho bull trout		92 / 36	2	<1	25 Jul	7	1	10 Sep
EPA bull trout		116	74	4	27 Aug			
Unnamed Creek - trib to Wet Creek ~200 m below Coal Cr., 20 m abv mouth.	24							
salmonid spawning (rainbow + brook)		43 + 22	38 + 1	7 / 1	5 Jul / 2 Oct	34 + 0	4	9 Jul
Idaho bull trout		90 / 52	28	2	4 Aug	16	3	10 Sep
EPA bull trout		114	114	9	27 Jul			
Wet Creek - at FS boundary	24							
salmonid spawning (rainbow + brook)		43 + 22	28 + 0	4	15 Jul	25 + 0	3	9 Jul
Idaho bull trout		90 / 52	8	1	4 Aug	15	2	10 Sep
EPA bull trout		114	114	6	27 Jul			

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Wet Creek - at Deer Creek Road	24							
salmonid spawning (rainbow + brook)		42 + 5	36 + 0	6	15 Jul	37 + 1	6	15 Jul
Idaho bull trout		89 / 35	47	3	21 Jul	19	3	9 Sep
EPA bull trout		113	113	6	3 Aug			
Wet Creek - ~100 m abv Dry Cr. Hydro	22							
salmonid spawning (rainbow)		40	35	6	15 Jul	39	6	9 Jul
Idaho bull trout		87 / 53	71	5	4 Aug	29	4	10 sep
EPA bull trout		111	107	10	26 Jul			
Wet Creek - ~200 m abv Little Lost River	22							
salmonid spawning (rainbow + brook)		45	17	3	9 Jul	35	3	15 Jul
Idaho bull trout		92 / 41	33	2	4 Aug	22	3	10 Sep
EPA bull trout		116	116	5	26 Jul			
Wet Creek - ~300 m above Coal Creek	24							
salmonid spawning (rainbow + brook)		40 + 22	13 + 0	2	5 Jul	2 + 0	< 1	9 Jul
Idaho bull trout		88 / 52	0			1	< 1	10 Sep
EPA bull trout		112	105	5	27 Aug			

Stream and Criteria	WBID	Days assessed[1]	SS inst. 13° / ID juvenile BT 12° / EPA BT 10°			SS daily avg. 9° / ID spawning BT 9°		
			Days	Max. # EC Over	Max Date	Days	Max. # EC Over	Max Date
Wet Creek - ~800 m above Hilts Creek	24							
salmonid spawning (rainbow + brook)		43 + 22	0 + 0			0 + 0		
Idaho bull trout		90 / 52	0			0		
EPA bull trout		114	56	1	27 Aug			
Williams Creek - ~ 3.5 km blw FS bndry	9							
salmonid spawning (rainbow + brook)		38 + 23	9 + 0	1	9 Jul	23 + 0	1	9 Jul
Idaho bull trout		85 / 53	0			14	1	10 Sep
EPA bull trout		109	101	4	27 Jul			
Williams Creek - ~ 1.6 km abv FS bndry	9							
salmonid spawning (rainbow + brook)		37 + 23	0 + 0			0 + 0		
Idaho bull trout		84 / 53	0			0		
EPA bull trout		108	0					

[1] Days assessed are the number of days for which a given criteria is applicable and the data are available to evaluate it.
[2] Idaho's bull trout criteria provide both a rearing and spawning temperature during non-overlapping time periods, a slash (/) separates the results from these two time periods, respectively.
[3] EPA's bull trout criteria provides only one temperature that applies to both rearing and spawning, thus the last three columns are grayed out on these rows.
[4] Temperatures were recorded and calculated to a hundreth of a degree, # of degrees over criteria is rounded to a whole number except that <1 indicates an exceedance of less than or equal to 0.50 °C.
[5] Criteria exceedances listed here do not take into account the exception for extreme hot weather allowed in Idaho's Water Quality Standards for bull trout criteria.
[6] A plus (+) seperates the values for non-overlaping spawning periods and should be summed to get the total number of SS criteria exceedances irrespective of species specific spawning periods. Species for which SS criteria were evaluated are indicated in parentheses (). Idaho's SS criteria was not evaluated for bull trout.